GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES • A McGRAW-HILL PUBLICATION

Power

DECEMBER
1954 • 50¢

An issue designed to be passed along

see page 79

1–Plant Offices
2–Electrical Shop
3–Material Storage
4–Assembly–Testing–Shipping
5–Machine Shop
6–Weld Shop
7–Stock Room
8–Tool Room
9–Boiler Plant & Research
10–Grinding Shop
11–Pattern Shop

A-S-H plant at Hamburg, Pa., in the "Pennsylvania Dutch" country, where skilled workers faithfully meet the equipment needs of A-S-H installations.

Modern, air-conditioned A-S-H general office building at Wynnewood, Pa., near Philadelphia.

We make our own equipment

Looking from the interior of Assembly, Testing and Shipping section deep into the Machining area of the Hamburg plant.

As pioneers in developing and installing systems for the removal of ash and dust from boiler plants, we attribute much of our progress to having our own production facilities—since 1929. In the main, the advantage is two-fold:

(1) ability to furnish tested equipment at the job site;
(2) freedom to translate individually-needed variations of design from drawing board into finished equipment with speed and economy.

So it is, with the vast experience of our Sales, Service and Engineering departments in Wynnewood, 22 Agents throughout the United States and in Canada, and the efficient responsiveness of our Production staff at Hamburg, A-S-H is in an eminent position to help you solve your ash or dust problem with the system that will give you maximum efficiency with minimum operating and maintenance costs.

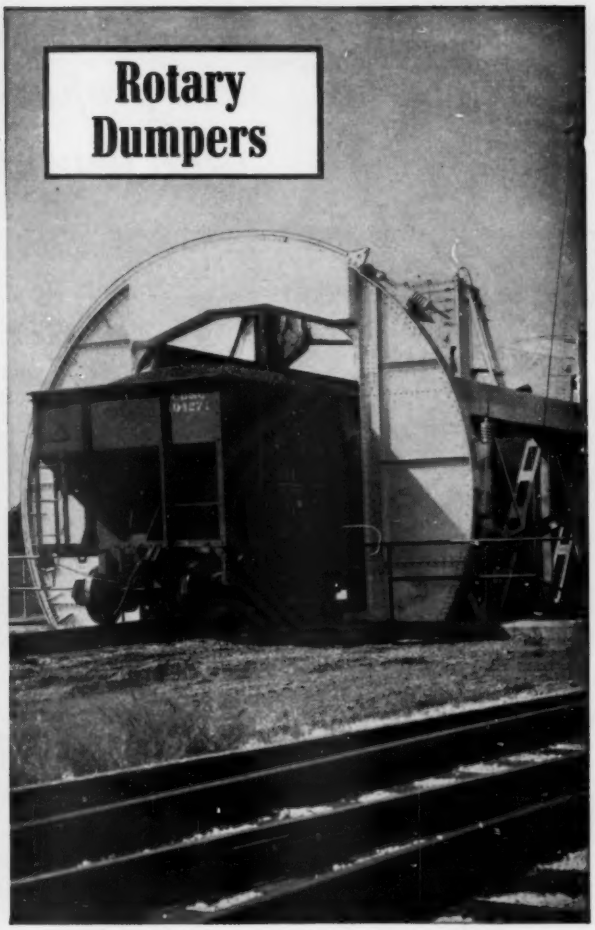
Pioneering advance continues with every job

THE ALLEN-SHERMAN-HOFF CO. Dept. A–259 E. Lancaster Ave., Wynnewood, Pa.
Offices and Representatives in Principal Cities

HYDROJET (hydraulic) **HYDROVAC** (pneumatic)

materials handling systems

EASIER ON CARS with minimum noise level . . . thanks to exclusive low-frequency vibration. The Link-Belt Car Shaker helps hopper cars empty themselves. Even hard-packed loads come "broom clean" in a matter of minutes. Especially good for damp, sticky materials. Write for Book 2345.



BOTTOMS UP . . . empties 90-ton car every 60 seconds or less (including return to upright position) by simply turning car upside down. Simple, automatic, foolproof. Takes all open-type cars—any length, width or height . . . up to 90-ton or 120-ton capacity. Book 2048-A has complete data.

Railroad cars come clean . . . in as little as 60 seconds or less!

For fast, safe, push-button car unloading . . . at substantial savings — choose Link-Belt equipment

IF you empty a few gondola cars a day—or several thousand a week, Link-Belt makes the right railroad car unloader for your particular requirements. Only Link-Belt builds both types—the automatic Rotary Car Dumper for large users . . . the low-frequency Car Shaker for smaller operations.

Both are precision engineered to reduce unloading hazards, minimize injury possibilities, cut costly demurrage charges.

Yes, if your operations require rapid railroad car unloading of any bulk material, it will pay you to call your nearest Link-Belt representative. He'll give you an unbiased recommendation for the right type of equipment for your needs.

LINK-BELT

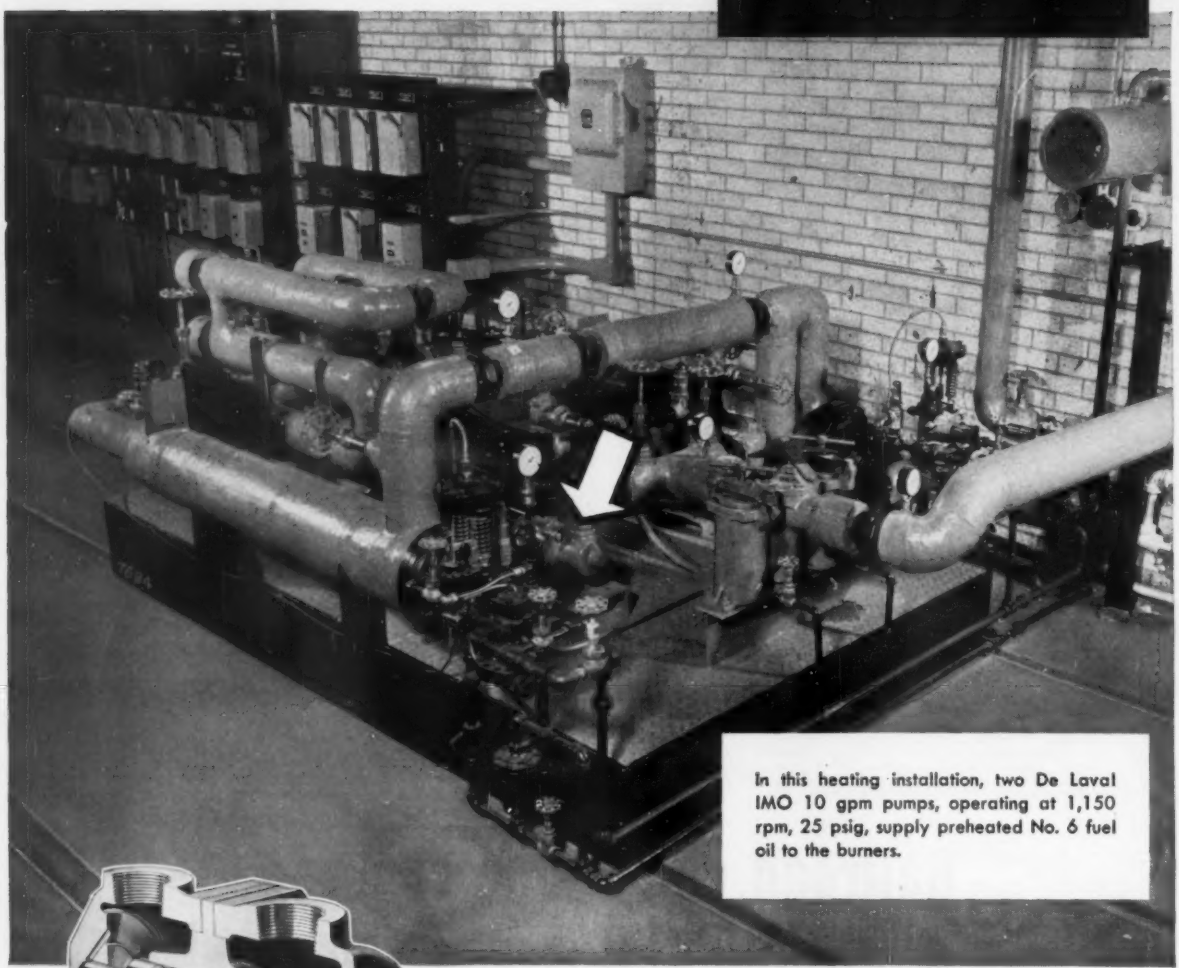
CAR SHAKERS and ROTARY DUMPERS

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities. 13,203

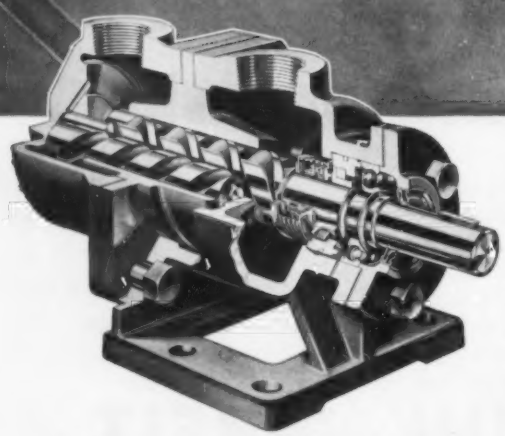
Contracts are more profitable when you install dependable

DE LAVAL

IMO PUMPS



In this heating installation, two De Laval IMO 10 gpm pumps, operating at 1,150 rpm, 25 psig, supply preheated No. 6 fuel oil to the burners.



A wide range of De Laval IMO models specifically built for fuel oil service is available. Capacities up to 80 gpm, pressures to 275 psig. Write today for Bulletin LG-A.

To increase your present—and future—profits on commercial heating jobs, install *dependable* De Laval IMO pumps on pump and heater sets. Their simple, trouble-free design saves you money on service calls . . . builds customer goodwill, for there's nothing to get out of order or need adjustment. No pilot gears, no sliding vanes, no reciprocating pistons. De Laval IMO's have only three moving parts—smoothly intermeshing rotors that propel the fluid axially in a steady flow without churning, pocketing or pulsation.

DE LAVAL *IMO Pumps*

DE LAVAL STEAM TURBINE COMPANY

815 Nottingham Way, Trenton 2, New Jersey

DL272

Power

DECEMBER 1954 • VOLUME 98 NUMBER 12

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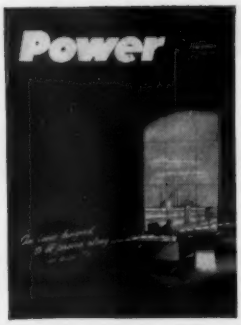


UNUSUAL is the word for our cover, as well as for the report to American executives beginning on p 79. Designed to be passed along to the top men in your firm, the report aims to point out the profit-making possibilities in the power services. In so doing, we hope to help you do an easier "selling" job of the dollar theme to management men in your company.

Next month . . .

■ "Frankenstein of Destruction"—a closed pressure system without pressure-relieving devices—gets a thorough review by Jim Myers of Black, Sivalls and Bryson, Inc. Once you read this roundup story, you'll be better able to select and apply safety heads for your entire plant.

■ And you'll surely want to see the rules for POWER's 1955 Modernization Program. By starting early you'll have more time to get your entry in on schedule. See the details of the award program in the January issue.

■ Guarding high-pressure boilers against corrosion can be tricky unless you have a good idea of typical causes. Shep Powell comes up with a comprehensive table giving you all the dope you need to help you spot trouble by appearance, location, cause. Don't miss this valuable tabulation.

■ For a brand new slant on steam traps be sure to read John Welker's neat article in January on steam "trapplications"—which John, an application engineer with Yarnall-Waring, says is the science of getting the right trap for a given job in your plant.

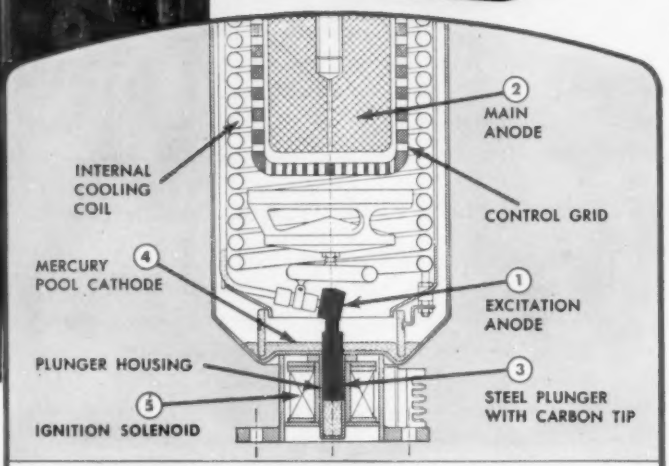
. . . and future months

■ Steve Elonka's typewriter is humming faster than ever these days. He's busy on POWER's March manual on Mechanical Packing. This is the second in a series of three on the subject of Seals, which includes the previously published "Gaskets" and a future one on "Mechanical Seals." We're sure you'll find the March manual a useful on-the-job tool.

Here's the Rectifier That Needs
No Delicate Adjustments

THIS 1000-KW, 615-VOLT DC, six-tube excitron rectifier is installed in an automatic transportation substation.

ALLIS-CHALMERS
Mercury Arc Rectifiers



Unique Plunger Starts Continuous Excitation

The excitron tube has an excitation anode ① in addition to the main anode ②. With the excitation circuit de-energized, the steel plunger ③ floating in the mercury pool cathode ④ makes positive contact with the excitation anode (as shown).

When the excitation circuit is energized, the ignition solenoid ⑤ pulls the steel plunger ③ away from the excitation anode ① and under the mercury pool cathode ④, thus drawing a dc arc and forming the cathode spot, which makes conduction of load current by the tube possible.

If power is interrupted the plunger will float up, contact the excitation anode and automatically re-establish the excitation arc when power is restored.

LITTLE MAINTENANCE IS NEEDED with Allis-Chalmers excitron-type rectifiers. Excitation of the excitron rectifier is continuous, while other types of rectifiers require re-ignition 60 times a second.

Since it is more difficult to start a rectifier arc than to maintain it, the excitron rectifier is much less likely to lose excitation during operation. Momentary dips in supply voltage which are encountered in many supply systems have no effect on the continuous excitation arc.

Years of operation in hundreds of installations have proved the reliability and ease of operation of Allis-Chalmers mercury arc rectifiers. You can get complete information from your nearby A-C office. Or write Allis-Chalmers, Milwaukee 1, Wis.

A-4432

ALLIS-CHALMERS

Power

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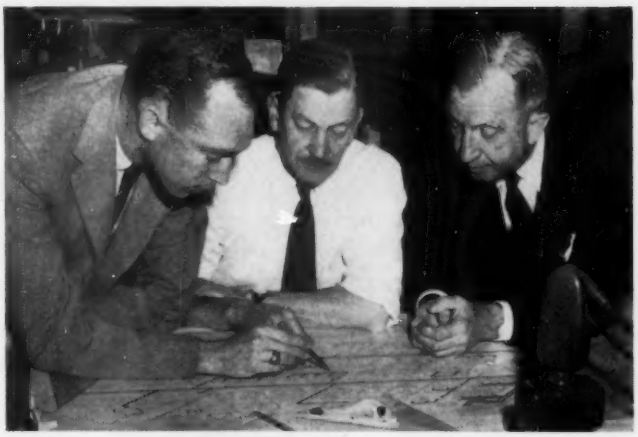
...with Power readers...

CELEBRATIONS AND CITATIONS . . . Presentation of the citations awarded for outstanding accomplishment in the POWER modernization program has turned out to be a lot of fun for the editors as well as for the recipients. As might be expected, the first presentation took place close to home—at a luncheon in New York's famous Waldorf-Astoria Hotel, only a few blocks from our offices. Photo above shows Tom Barrett, building superintendent of the Waldorf, receiving citation from Lou Rowley. Looking on are Eric Roos and A W Knecht. Their firm—Seelye, Stevenson, Value & Knecht—were consultants on

(*Continued on page* 214)

...lines and bylines



Kallen, Huget and Swain look over fold-out for . . .

Power's Report to America's Executives

Nearly two years in the making, the report to America's executives, which begins on p 79, aims to help solve a major problem turned up in well over 100 survey visits by the POWER staff. This is the tough job power-service men face in "selling" their ideas to management —getting across their view that power-service profits are as real and as big as those from direct production.

So this report, unlike any in POWER's history, is designed for a different audience—the busy top-management man. It outlines the power services, shows how they serve production, points up profit opportunities, and indicates the essentials of sound relationships between management and the engineers in the power services.

Preparation of the text and rough illustrations was a three-man job with Lou Rowley, *Editor*, Phil Swain, *Consulting Editor*, Howard Kallen, *Assistant Editor*, combining their talents to produce the easy-to-read words and eye-catching drawings.

All McGraw-Hill art services were called into play for this job, including the art staff of the Technical Writing Service. Shown above with Phil and Howie is Jim Huget, a member of the Illustration Department since 1940. Jim's wide experience proved invaluable in producing finished art for the fold-out appearing on p 95.

SELECTING PERSONNEL is a subject K M White, chief engineer, Central Electric Power Cooperative, really knows well, as you can see from his article, beginning on p 125.

K M White

Starting his power-plant work after high-school graduation, he went from helper to fireman, operator, water chemist and boiler-room foreman.

From here he took to the sea, supervising aircraft-carrier fire rooms while these big babies made their trial runs.

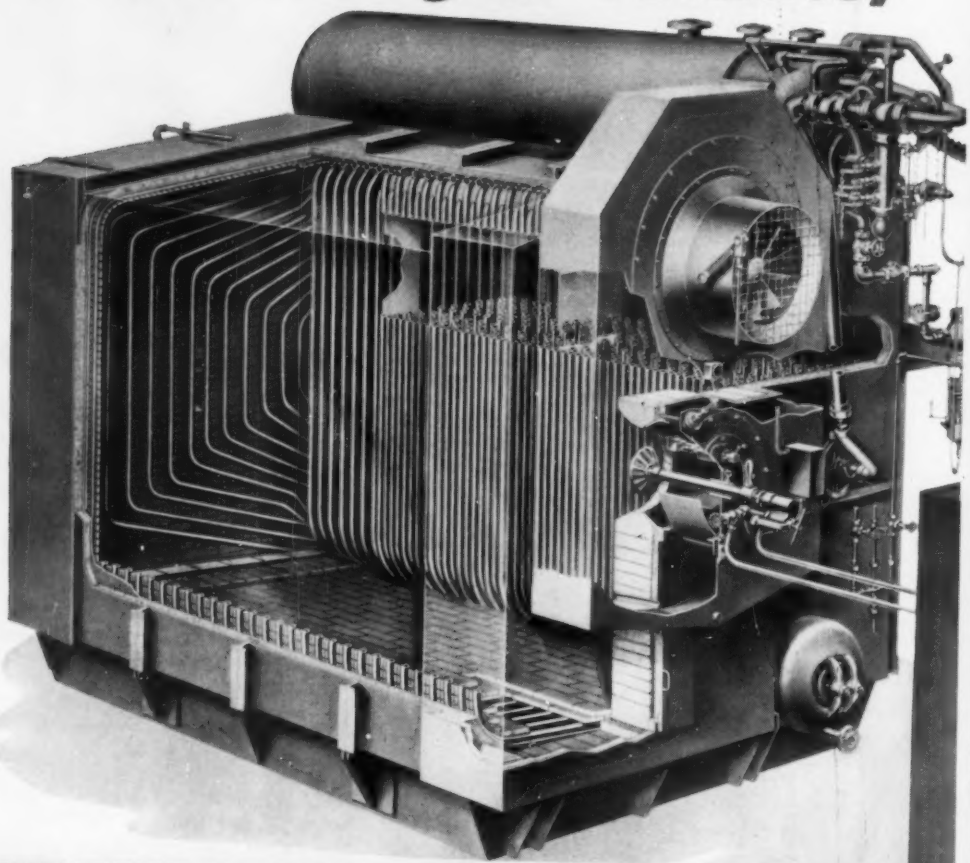
Back on land again, White spent two years as results engineer, was then promoted to chief engineer of the 15,000-kw Beaver Channel, Clinton, Iowa plant. In '51 he transferred to his present plant at Chamois, Mo.

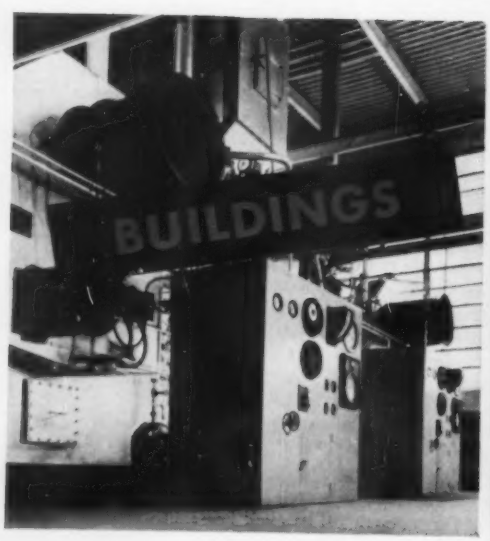
His big hobby of the moment is mink raising. He now has over 100 minks, some of which he is breeding for new mutations. White also enjoys writing POWER articles, has had several in previous issues.

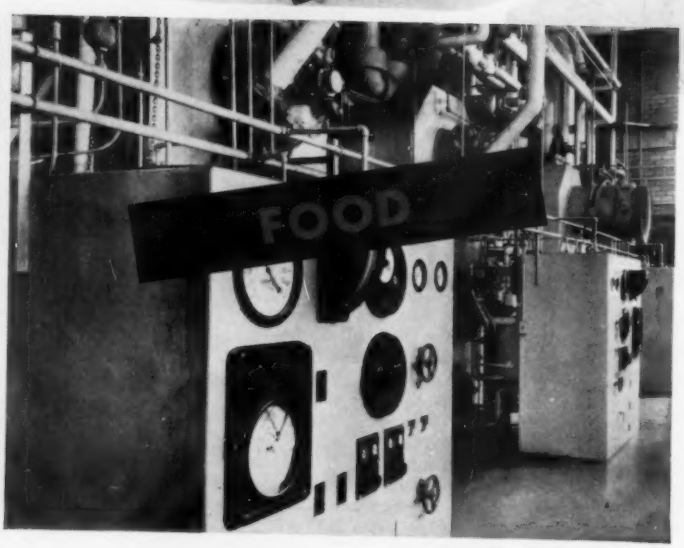
keeping steam cheap . . .

DECREASE

with B&W Integral-Furnace,



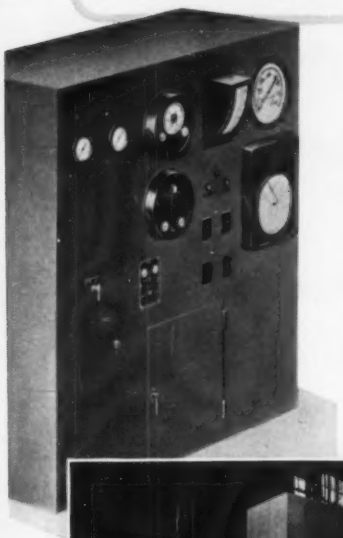




STEAM COSTS
Type FM Boilers

COST-SAVING FEATURES of the B&W Type FM Boiler

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Suitable for Outdoor Service
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation



As the operation of average steam facilities for power, heat, processing, or any combination of these, represents a substantial portion of annual costs, it may pay you to take a serious look at your present steam plant. You may find that operating costs are out of all proportion to requirements and are making a sizeable dent in net profits.

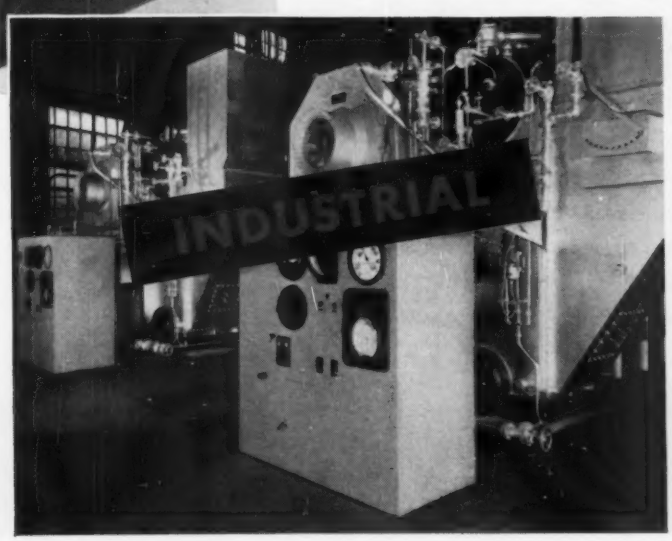
Many companies already have made installations of B&W Type FM Boilers, similar to those shown below, to provide steam for a wide variety of services. And wherever installed, to meet heating loads and other building requirements, variable industrial loads, or combination services, the FM Boiler has provided dependable, economical operation and has satisfied all requirements for which it was installed.

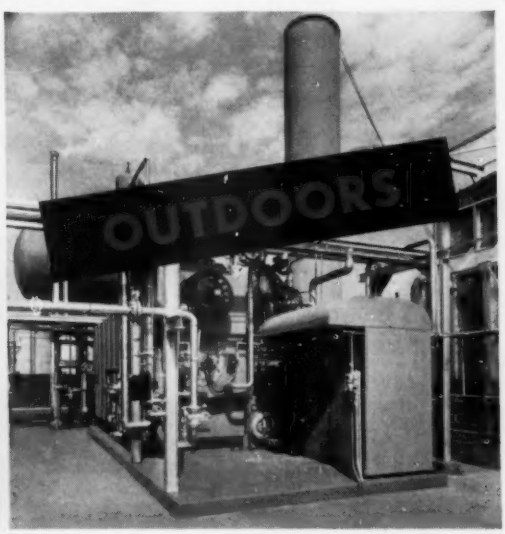
For example, such diversified FM Boiler users as a laundry, hospital, vehicle manufacturer, pharmaceutical house, fibreboard company and paper company — to list but a few — have reported savings of 20%, 25%, and even 30% on fuel alone, as compared with earlier fuel consumption data. And in many instances, these reduced fuel costs along with additional related savings attributable to FM Boiler operation, amount to thousands of dollars annually.

Write for your copy of Bulletin G-76A which describes this self-contained small boiler. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

BABCOCK & WILCOX
BOILER DIVISION

G-684





Boiler Cleaning Modernization Pays

a High Return on the Investment

Substantial improvements in boiler cleaning equipment (and in its application and use) have been made in the last few years . . . since the great majority of boilers now in service were installed. Each year we learn more about boiler cleaning and are consequently able to do a progressively better job.

This is a good time to examine your boiler cleaning with a critical eye . . . to determine if it is up-to-date or if a modest investment will bring substantial returns in: (1) improved availability, (2) fuel saving, (3) labor saving, (4) increased capacity, (5) better operation and (6) lower boiler maintenance.

Listed below are a few of the plants that have found it profitable to modernize their boiler cleaning with Diamond equipment. We can tell you of instances where this equipment has paid for itself in less than one year. We shall be glad to send you additional information on Diamond equipment or to make a survey of your present boiler cleaning to determine if it can be modernized to your profit. Just return the coupon.

Representative Plants That Have Purchased Diamond Equipment for Modernizing Boiler Cleaning:

Alabama Power Company, Gorgas Station
Bethlehem Steel Company, Johnstown, Pennsylvania
Carbide & Carbon Chemical Co., Institute, West Virginia
Central Maine Power Co., Bucksport, Maine
Central Paper Company, Muskegon, Michigan
Cleveland Electric Illuminating Co., Lakeshore Station
Connecticut Light & Power Company, Devon Station
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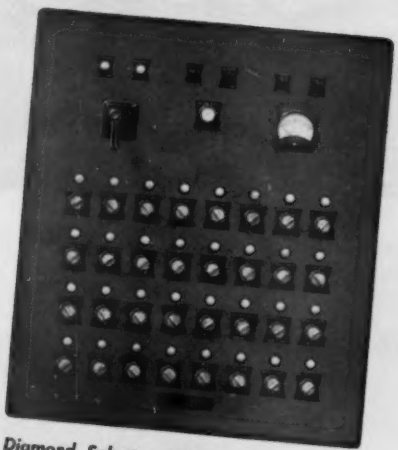
6975

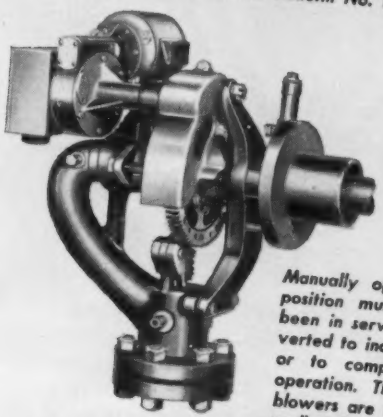
DIAMOND POWER SPECIALTY CORPORATION

Diamond Model IK long retracting lance type blowers have been added to many existing boilers for improved cleaning of tube banks. They have also replaced numerous permanently-installed multi-nozzle blowers in high temperature locations. Ask for Bulletin 1080.

Diamond Model IR short retracting lance type blowers are frequently added to clean water-cooled furnace walls or narrow portions of adjacent tube banks. They operate in extremely high gas temperature zones and are capable of cleaning all dust and most slag deposits over a wide radius from the nozzle. Existing manually operated installations can be motorized in the field. Ask for Bulletin No. 1079.



Diamond Selectromatic Control Panel for establishing and carrying out a blowing cycle of any and all degrees . . . from single unit selection and operation to complete automatic sequential program control. Provides more information at the panel and requires no attention after program starts . . . calls for help when there is trouble and tells what is wrong and where.



Manually operated Diamond G9B fixed position multi-nozzle blowers that have been in service for years are easily converted to individual push button operation or to completely automatic sequential operation. This is a field change . . . blowers are not removed from the boiler wall. Ask for Bulletin 1137.

LANCASTER, OHIO

Diamond Specialty Limited · Windsor, Ontario

DIAMOND POWER SPECIALTY CORP. U
LANCASTER, OHIO

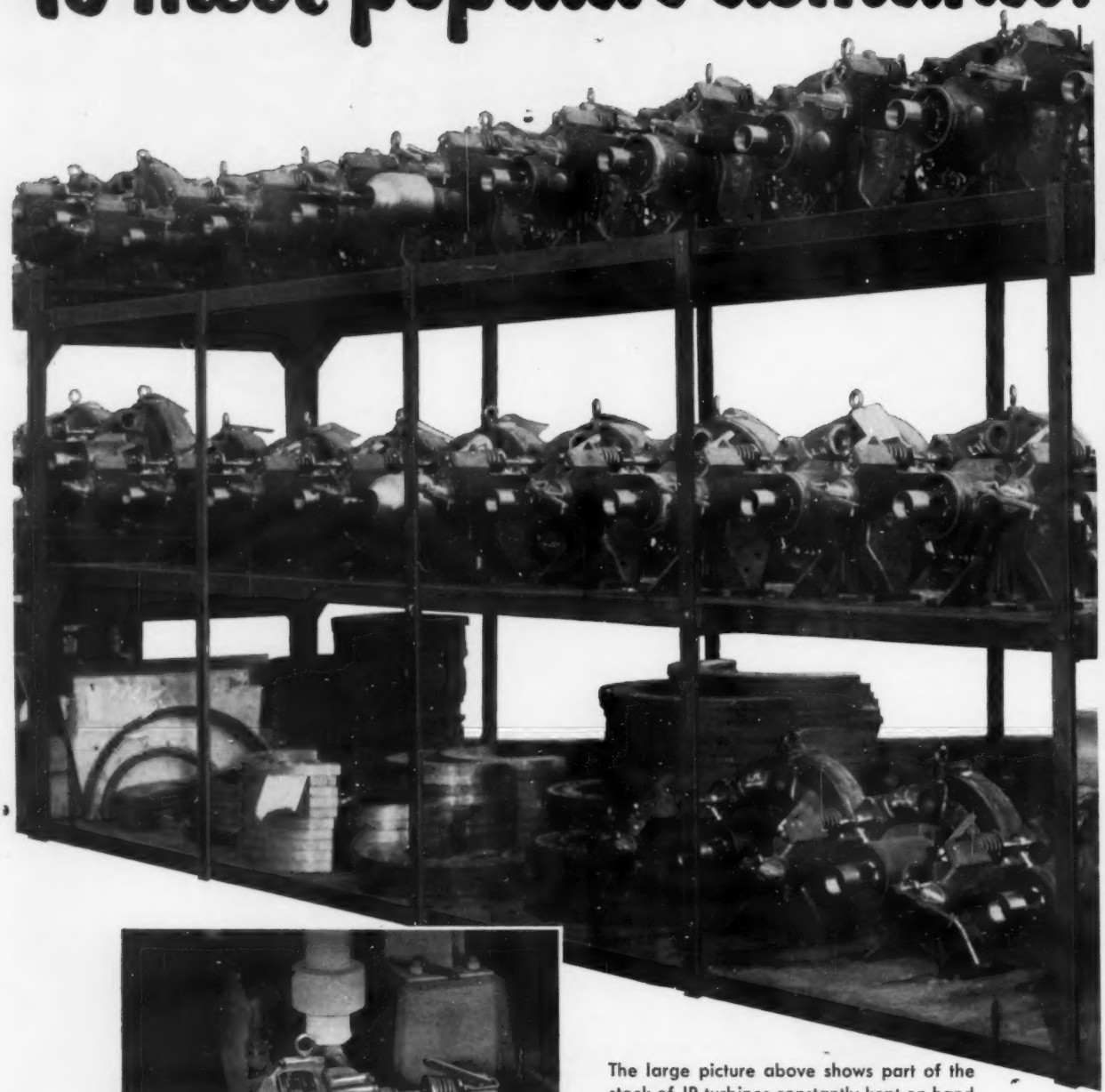
I am interested in the items checked:
☐ Bulletin 1079 ☐ Bulletin 1080 ☐ Bulletin 1137
☐ Survey of my boiler cleaning and how it can be improved. This entails no obligation on my part.

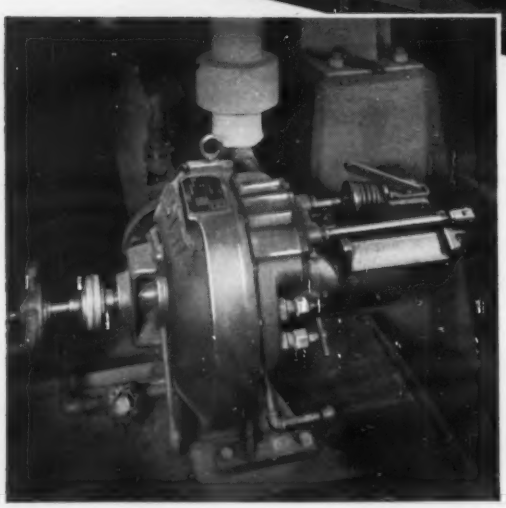
NAME_____

COMPANY_____

ADDRESS_____

To meet popular demand.





The large picture above shows part of the stock of JR turbines constantly kept on hand for quick shipment. At left, on the lower shelf, are standard YR turbine nozzle ring blanks, which are always available to meet maintenance needs quickly.

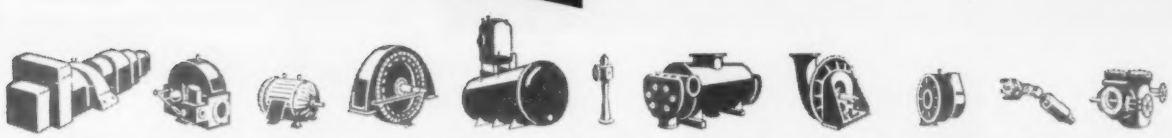
At left, an Elliott JR turbine coupled to a small pump. This picture shows the emergency trip mechanism and the two hand valves.

ELLIOTT JR MECHANICAL DRIVE TURBINES

are in big demand wherever conditions call for a small turbine of minimum first cost. Without sacrifice of ruggedness or reliability, these turbines are engineered for production as well as for performance. This junior member of the Elliott turbine family has everything needed to operate up to high Elliott standards. Equipment includes direct-acting mechanical shaft constant-speed governor, built-in emergency over-speed trip operating an independent positive-closing emergency trip valve, hand speed changer, two hand valves, removable carbon packing rings, chromium plated shaft under the carbon rings, and grease-packed shaft and governor ball bearings.

Elliott JR turbines are production built, preassembled, stocked and ready for 24-hour shipment. Contact your local Elliott field engineer for full details, or write Elliott Company, Jeannette, Pa., for a copy of the JR Turbine Bulletin H-20A.

ELLIOTT Company



TURBINE-GENERATORS TURBINES MOTORS GENERATORS DEAERATING HEATERS EJECTORS CONDENSERS COMPRESSORS TURBOCHARGERS TUBE CLEANERS STRAINERS

How to Control

FORMULA for Cutting Production Costs

(BAILEY Design) + (BAILEY Engineering) + (BAILEY Service)

= GREATER SAVINGS PER FUEL DOLLAR

Control Room at Highgrove Power Plant of California Electric Power Co., Riverside, Calif. In this "outdoor" plant Bailey Control of Combustion, Feed Water, Steam Temperature, Air Heater Temperature, and Fuel Oil Temperature, assists operators in producing low cost steam.

Units 1 & 2 are each rated at 320,000 lb per hr capacity, 850 psi, 900F. They may be fired with gas or oil.

Steam Cost

★ Close regulation of fuel and air input is vital to a strict control of your steam cost. But that's not all. You'll need control of other factors too. Your power costs can be held down only by controlling all of the important operations in your steam plant. That's where you can be sure of help from Bailey Controls. Here's why they can do the job and do it right:

1. Complete Range of Equipment—fully co-ordinated

You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, as might be the case if he had only a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. Engineering Service—backed by experience

No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement, and automatic control.

3. Direct Sales-Service—conveniently located near you

Bailey Meter Company's Sales-Service Engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

For close control of steam cost, more power per fuel dollar, less outage, and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey Engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More Power To You!"

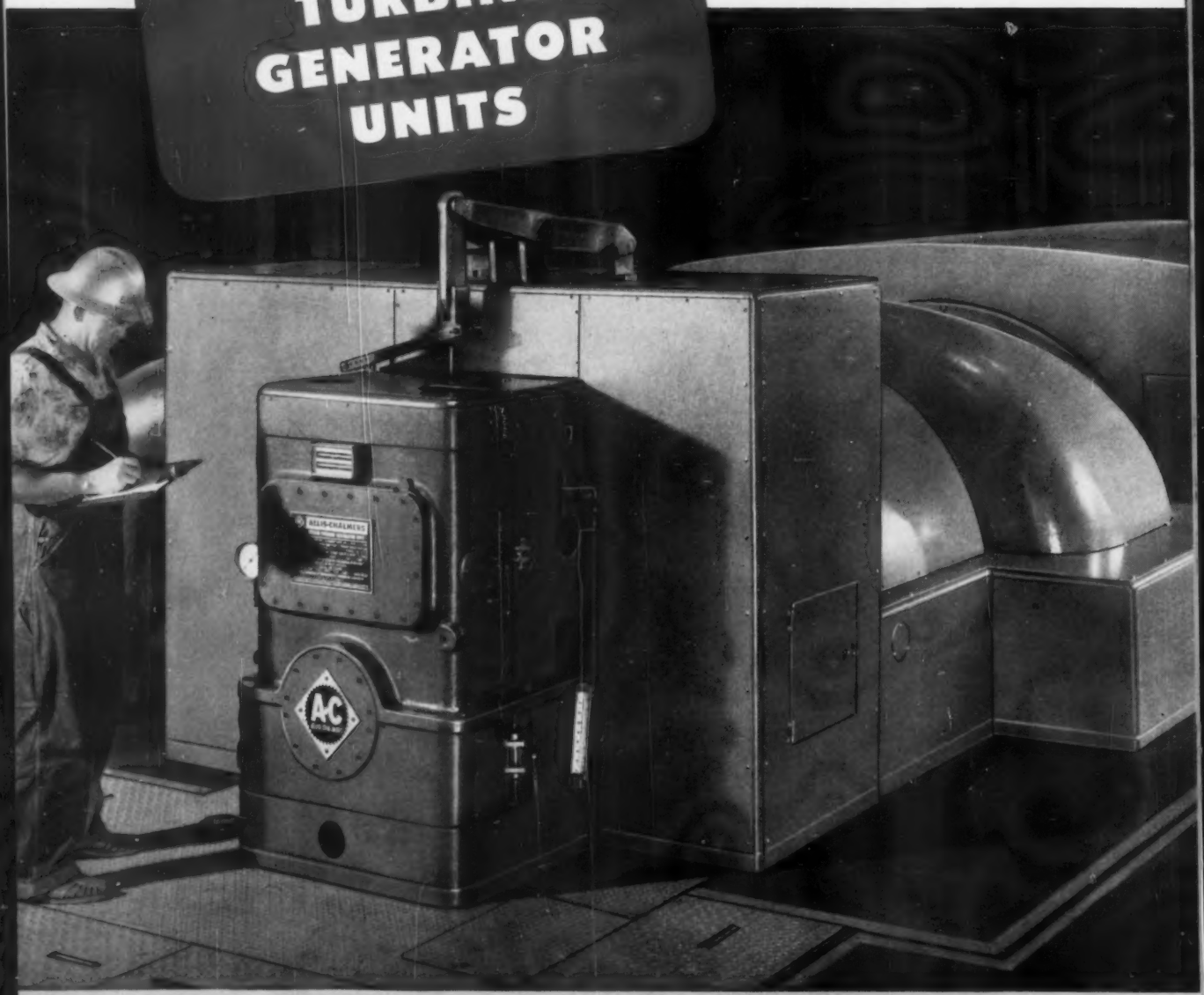
A-118-2

BAILEY
METER COMPANY
1036 IVANHOE ROAD
CLEVELAND 10, OHIO
Complete Controls for Steam Plants

BAILEY METERS
Controls for
COMBUSTION
FEED WATER
TEMPERATURE
PRESSURE
LIQUID LEVEL
FEED PUMPS

Choice for

WA-Series STEAM TURBINE GENERATOR UNITS



COMPLETE POWER PLANT at Tuscola includes three boilers and two WA-Series steam turbine generator units, shown above. Allis-Chalmers also supplied condensers and condensate pumps for the plant.

1904 50 1954
YEARS
of
TURBINE

ALLIS-

New $44,000,000 Petro-chemical Plant

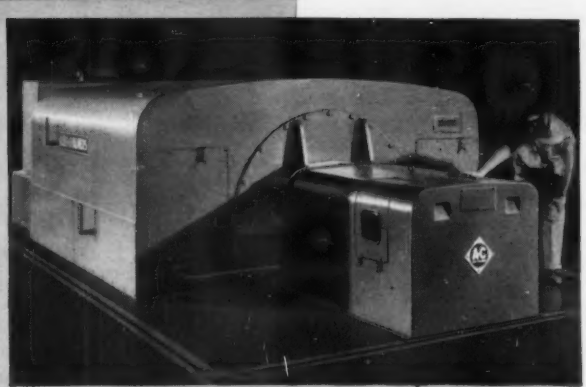
Two units generate power as by-product from steam required for processing natural gas

NATIONAL PETRO-CHEMICAL CORPORATION'S new Tuscola, Illinois, plant takes up to 425 million cubic feet of natural gas from the adjacent Panhandle Eastern pipeline, extracts 10 million cubic feet of ethane for cracking into valuable industrial chemicals, and returns the gas to the pipeline for transportation to big city customers.

To synthesize this huge amount of ethane into ethylene, hydrogen, and later into other useful components, fractionation and low temperature separation are used. The processes require 600,000 pounds per hour of steam, which is produced at 625 psig, 750 F.

Two condensing, automatic extraction WA-Series steam turbine generators are utilized to produce 10,000 kw of power from the steam before it is delivered into plant processes. The steam is delivered directly into the high temperature side of the automatic extraction impulse turbines, from which it is extracted at 65 psig for use in the plant. Each turbine generator unit is equipped with a housing-type, air-cooled generator and exciter. The entire units are carefully engineered and manufactured to operate as integrated units, 24 hours a day, 7 days a week.

WA-Series steam turbine generator units match the most modern plant design to provide high efficiency power or process steam. They are available in condensing or non-condensing types in NEMA ratings 2000 kw and larger. Bulletin 03B7654 gives complete facts. For your copy just call your nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4477



OUTBOARD END of one unit shows exciter housing.

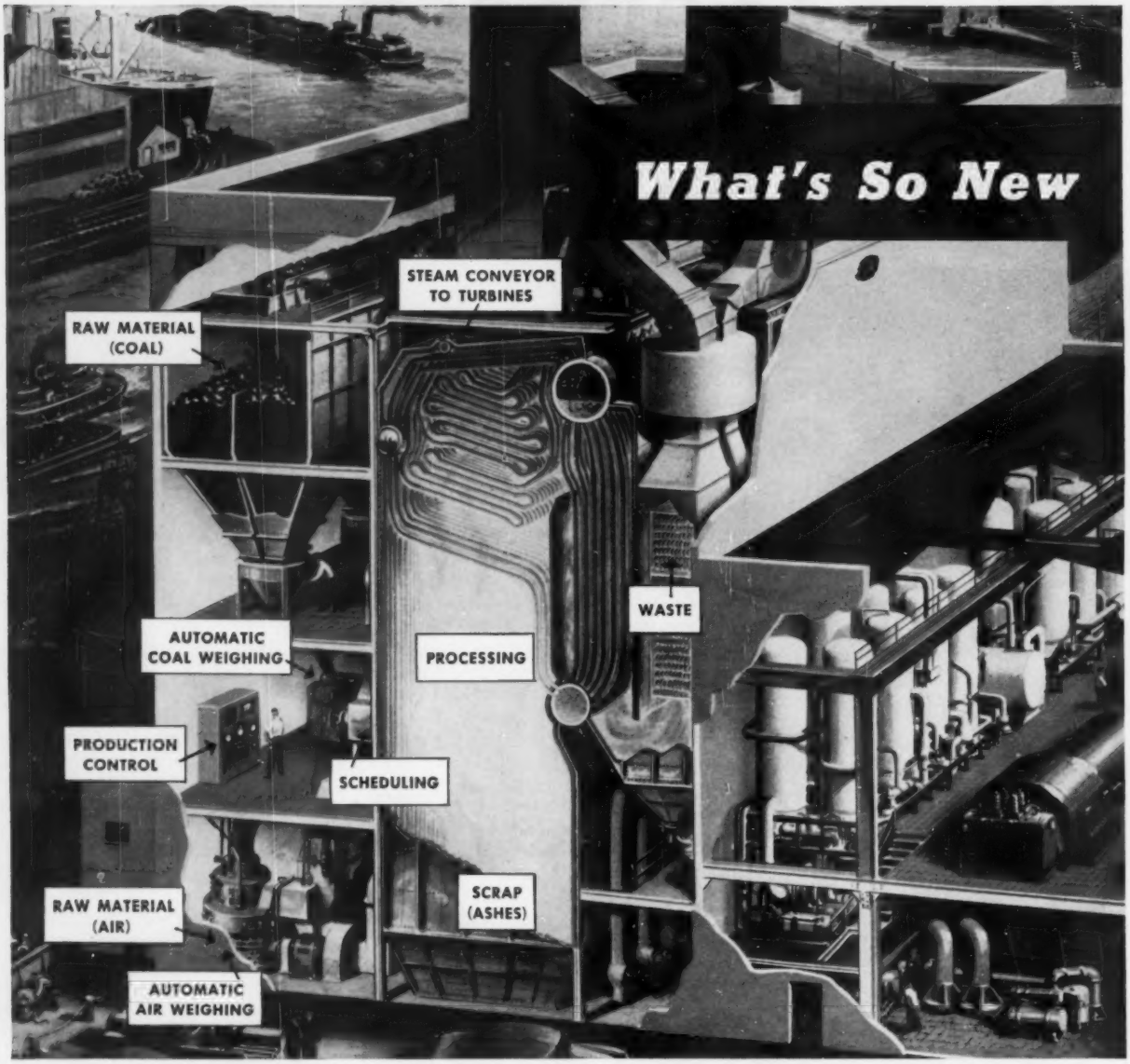
Simplified Installation and Maintenance

Every detail of WA-Series steam turbine generator units is designed for maximum simplicity and maintenance. Three-bearing construction, above-the-floor oil piping, and bracket-bearing, housing-type air-cooled generator are some of the features that result in a compact unit with simplified installation requirements. Turbine and generator are shipped with their rotors locked in place, further minimizing installation time.

Maximum reliability is assured by labyrinth spring-back steam seals throughout, removable external glands, high chrome alloy steel buckets and nozzles, and a time-proved governing system.

CHALMERS

A-C ALLIS-CHALMERS



View Courtesy of the Armstrong Cork Company

This Is How a Factory Man Might Look at a Power Plant

That's because, in most plants, it's a completely automatic manufacturing operation, converting fuel and air into available heat and condensate and make-up water into steam for processes and turbine generators. Instruments and controls make it possible to achieve the full efficiency that has been built into the modern power plant.

REPUBLIC FLOW METERS CO.

About Automatic Factories?

. . . Power "Factories" Have Been Operated Automatically for Years!

THEY say it's coming — automatic production of automobiles, appliances and the thousands of other things we need and use. It's a startling thought, this idea of factories that will need only human supervision and maintenance and nothing more.

Yet, when you look at your own power plant, the idea doesn't seem so new after all. For power plants are actually factories. They produce products — steam and electricity — that are distributed, sold and used by millions daily.

PIONEERS OF AUTOMATIC FACTORIES

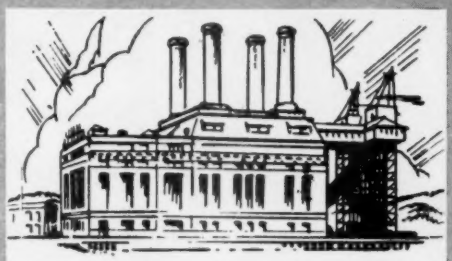
It is the power industry that has actually pioneered automatic factories. Almost 30 years ago the first power plant was operated entirely by automatic controls. Control principles learned from this and thousands of subsequent installations are guiding today's designers of the factories of tomorrow.

The Smoot Engineering Corporation, which made this first control installation, was acquired by Republic Flow Meters Co. some 20 years ago. Since then, Republic has carried on the Smoot leadership in the automatic operation of power plants, manufacturing a complete line of instruments and controls for this purpose. For example, a recent Republic development, the Electronic Telemaster, has made possible the control of large boilers where components are so distant that transmission lags in ordinary control systems would prohibit automatic operation.

With this wealth of past experience and an active development program to guide them, Republic engineers are able to give you the latest features in control systems to best meet your present and *future* needs.

REPUBLIC Automatic COMBUSTION CONTROLS

- For all types and sizes of boilers
- For all arrangements of draft
- For all types of fuel firing
- For all load conditions

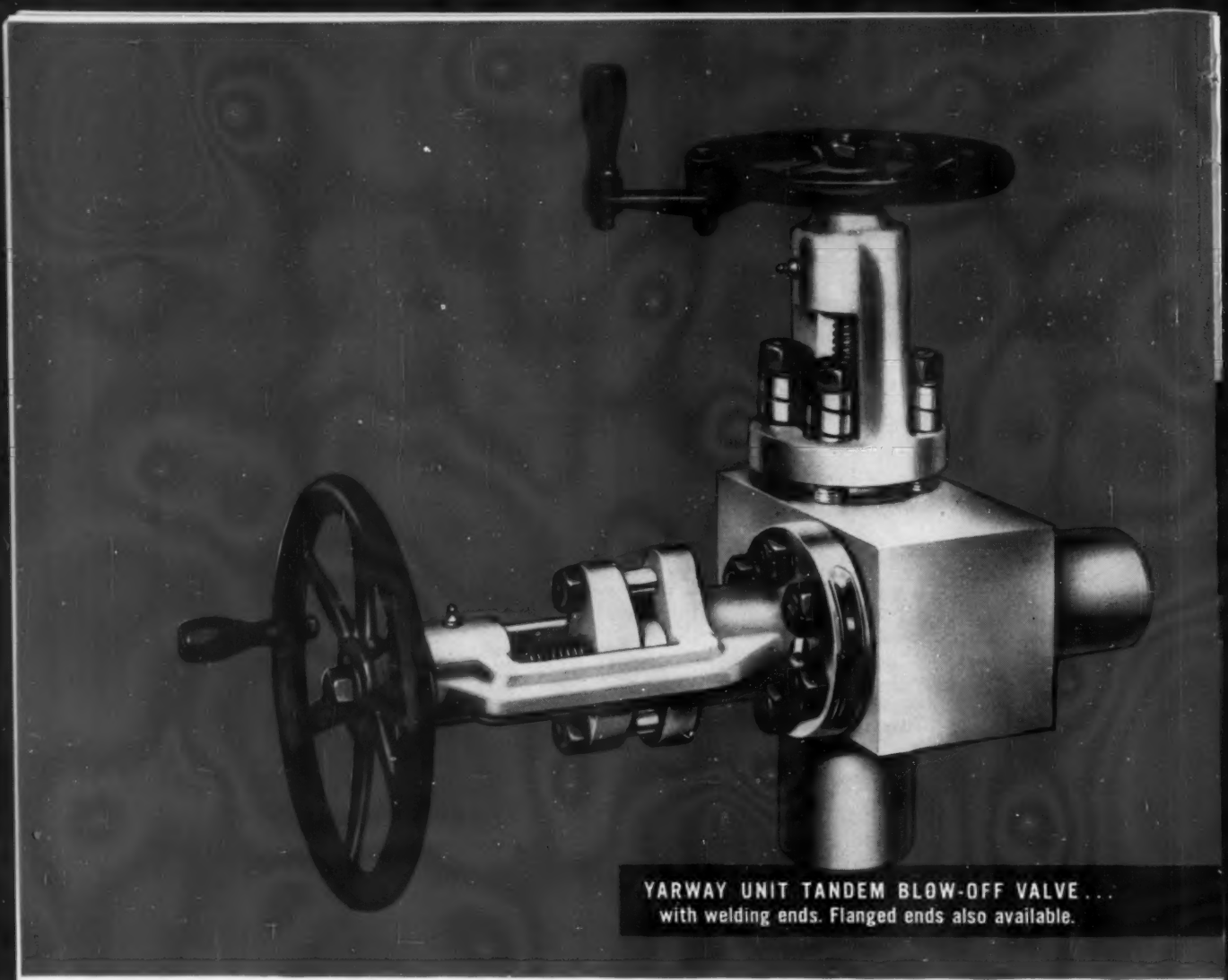


SHERMAN CREEK STATION

WHERE AUTOMATIC POWER PLANT OPERATION WAS FIRST PROVED PRACTICAL . . . 30 YEARS AGO!

In 1922, Smoot Controls (now incorporated into the Republic line of instruments and controls) were installed on four boilers at New York's Sherman Creek Station in an experiment to test the feasability of controlling combustion automatically. Within five months, the superior performance of boilers with these controls was so conclusively demonstrated that the entire plant, consisting of 44 boilers, was equipped with Smoot Controls. After this test proved it was practical to control boilers with other machines, it was only a short time before automatic boiler controls were installed in scores of power plants all over the country.

2240 Diversey Parkway • Chicago 47, Illinois



YARWAY UNIT TANDEM BLOW-OFF VALVE . . .
with welding ends. Flanged ends also available.

BUILT TO "TAKE IT" AT

HIGH PRESSURES

● As boiler pressures go up . . . so does the demand for Yarway Unit Tandem Blow-Off Valves. *Why do more than 4 out of 5 high-pressure boiler plants now use Yarway Blow-Off Valves?*

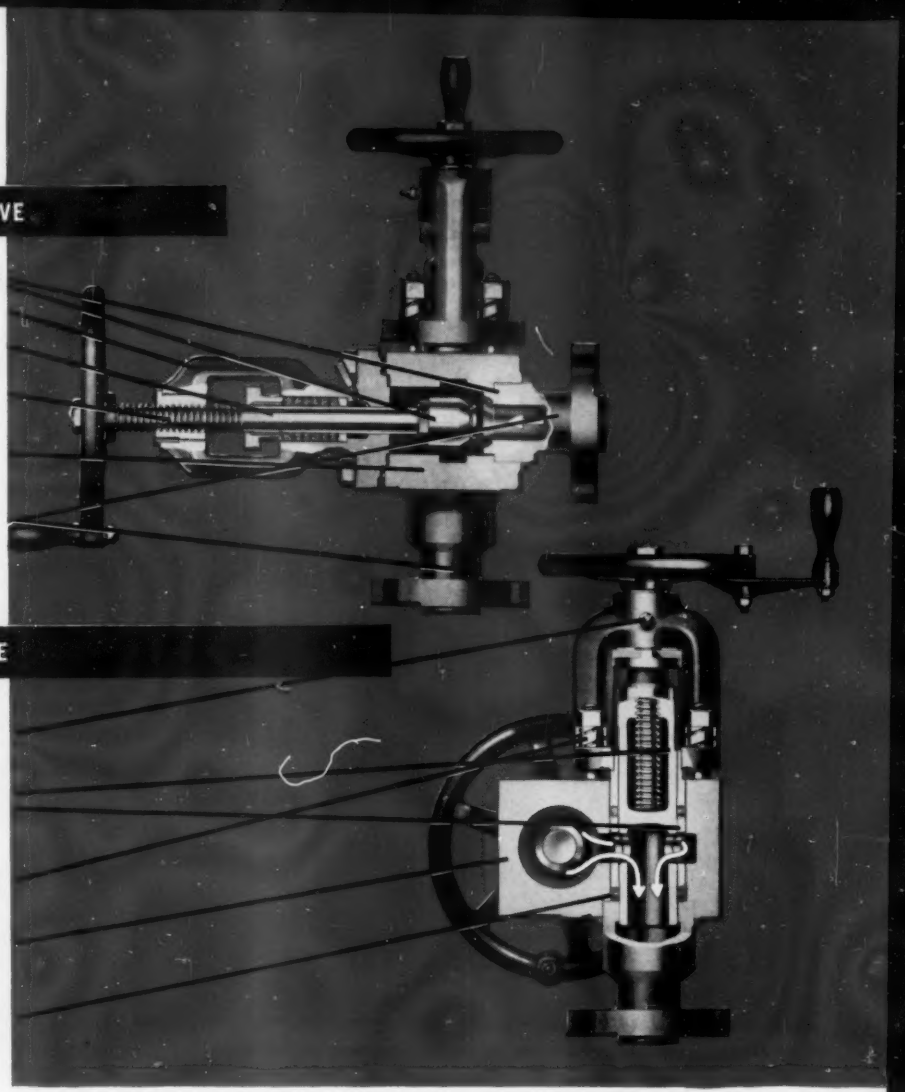
Yarway Unit Tandems are designed for strength, built to safeguard lives and investments, and to withstand severest acid-wash service.

A rugged, compact one-piece forged steel block serves as the space-saving common body for both valves, eliminating intermediate connections. Stelliting on seats and discs in the hard-seat valves provides longer life and better service. Balanced sliding plungers do the same on the seatless-type valves. Other design and metallurgy features add a high safety factor.

A FEW TYPICAL USERS

UTILITIES

Philadelphia Electric Company
Pacific Gas and Electric Company
Dallas Power and Light Company
Boston Edison Company
Cleveland Electric Illum. Co.



HARD-SEAT (Blowing) VALVE

Stellited and ground disc and seat.

Cast Steel Yoke.

Stainless steel stem.

Alemite lubrication (fitting on yoke hub) of stem and bushing threads.

One-piece forged body of carbon steel. Carbon-moly steel available on request.

Inlet and outlet nozzles welded into body. Flanged or welding ends provided.

SEATLESS (Sealing) VALVE

Alemite lubrication of plunger and ball thrust bearing in yoke.

Nitralloy plunger and lower follower gland. Stainless steel plunger and Ni-Resist gland available for acid wash service.

Yoke springs maintain required pressure on packing at all times.

One-piece forged body of carbon steel. Carbon-moly steel available on request.

Laminated lower packing ring with stainless steel reinforcing inserts.

Unit Tandems are available in the hard seat—seatless valve combination for pressures to 1500 psi, or in the hard seat—hard seat combination for pressures to 2500 psi. Both provide positive opening and closing with drop-tight shut-off.

Write for Yarway Bulletin B-434.

YARNALL-WARING COMPANY

100 Mermaid Avenue, Philadelphia 18, Penna.

BRANCH OFFICES IN PRINCIPAL CITIES

WHAT'S NEW AT YARWAY?

See the Yarway Exhibit, Booths 513-517 at the National Power Exposition in Philadelphia, Dec. 2-7.

YARWAY® / blow-off valves

Toledo Edison Company
Georgia Power Company
Union Electric Co. of Missouri
Rochester Gas and Electric Co.
Indianapolis Power and Light Co.

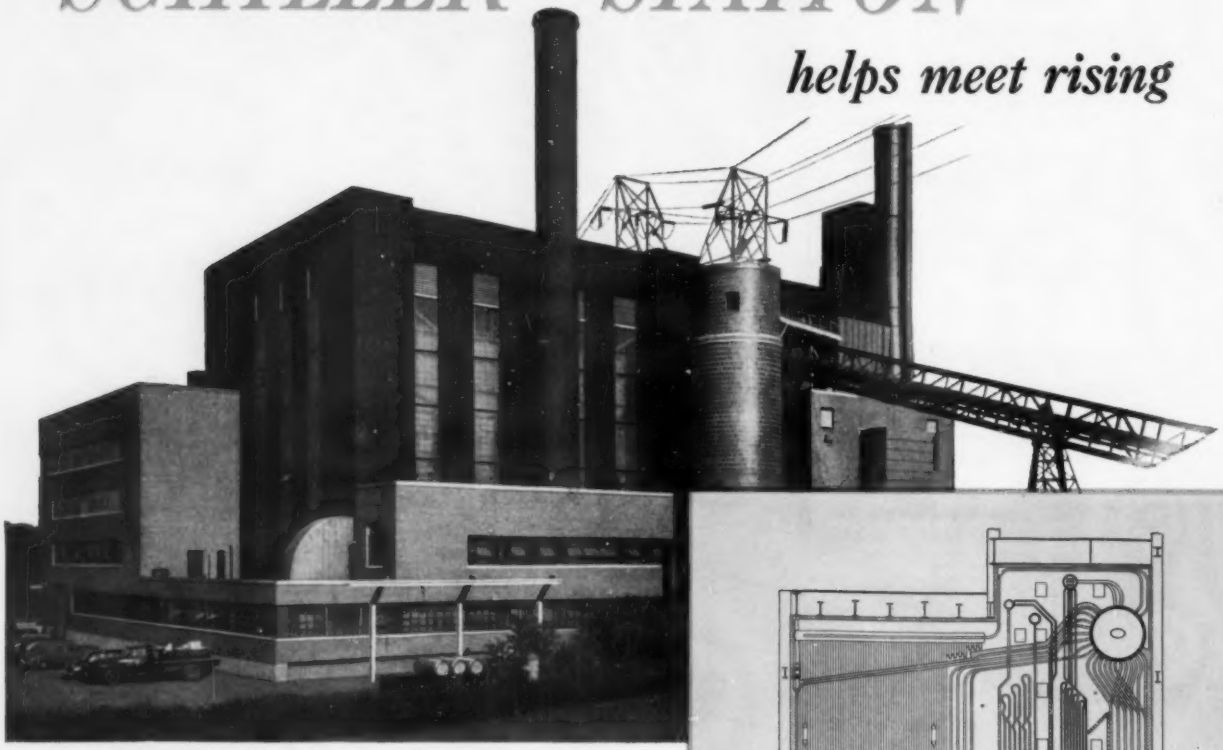
INDUSTRIAL PLANTS

Bethlehem Steel Company
Ford Motor Company
Weyerhaeuser Timber Co.
Anheuser Busch Company
Procter & Gamble Company

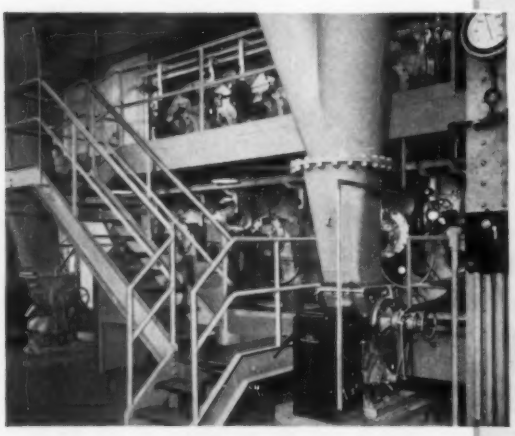
Southern Kraft Corporation
Chrysler Corporation
Container Corp. of America
Eastman Kodak Company
American Viscose Company

SCHILLER STATION

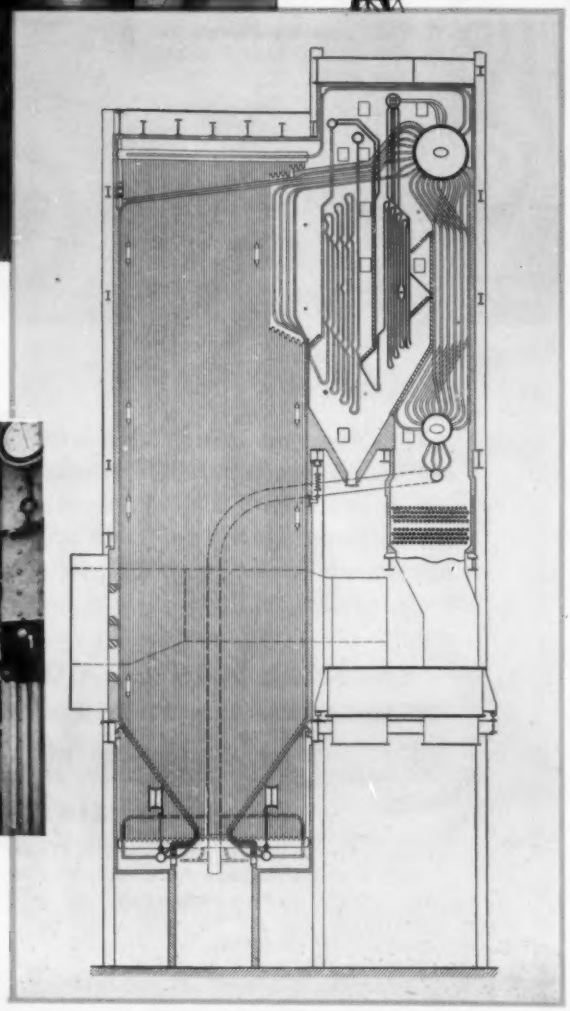
helps meet rising



Looking east toward Schiller Station and the Piscataqua River. Addition housing FW steam generator now being erected on the right of the present structure. Consulting Engineers: Jackson & Moreland, Boston, Mass.



View showing oil burners serving Foster Wheeler boiler. Fuel consumption 65 gallons of oil per minute.



Cross-section of one of two identical Foster Wheeler 2-drum steam generators at Schiller Station, Portsmouth, N. H. Design pressure 1475 psig; final steam temperature 950F peak capacity 450,000 lbs per hr.

demand for electric service in New Hampshire

Foster Wheeler 450,000 lb per hr steam generator, installed in Schiller Station of Public Service Company of New Hampshire, has augmented station's capability by over 50,000 kilowatts. A second Foster Wheeler unit, now under construction, will contribute an additional 50,000 kilowatts to the rapidly growing power-producing facilities of this business-managed utility.

Reddy Kilowatt

SCHILLER STATION of Public Service Company of New Hampshire was first opened in 1950. But, to meet the ever-growing demand of New Hampshire's thriving industries, farms and homes, in the four short years that have passed, Public Service has found it necessary, upon two occasions, to increase the power-producing facilities of this station.

In the first addition, a two-drum Foster Wheeler steam generator — complete with superheater, economizer and waterwalls as shown in the accompanying cross-section — was installed. This added 50,000 kilowatts to the station's capability. For the second addition, now being constructed, an identical Foster Wheeler steam generator is specified that will contribute an added 50,000 kilowatts.

This installation is another example of Foster Wheeler's ability to design and construct equipment to meet exacting power-producing needs — equipment that reflects the engineering ingenuity of an organization long recognized as a pioneer in the field of steam generation. *Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.*

**Trade mark character used by permission of Reddy Kilowatt, Inc.*

FOSTER WHEELER

"Dated" instruments drain away dollars

Instruments can become outmoded . . . just like automobiles and ideas. Progressive instrument development is constantly making many older designs obsolete . . . and such obsolescence can be a steady drain on profits.

Modern instruments save money

Honeywell engineers are proving this fact every day—in a growing number of plants, on all types of processes. Where out-of-date controls have been replaced by modern Honeywell instrumentation, economy-minded engineers and management men have really opened their eyes. And with good reason, for—

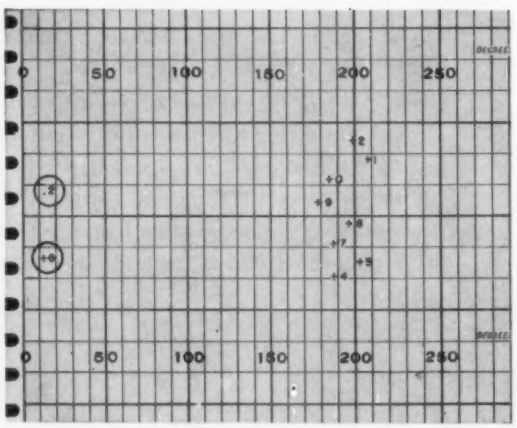
- Modern Honeywell instrumentation saves labor. Centralized control, automatic time-cycle systems, and other recent control concepts save countless wasted steps . . . reduce routine man-hour expenditures.
- Modern Honeywell instrumentation cuts maintenance costs. It affords longer, uninterrupted operation . . . is designed for easy service . . . requires minimum attention.
- Modern Honeywell instrumentation reduces rejects. It maintains the tighter process tolerances demanded by today's more exacting specifications.
- Modern Honeywell instrumentation improves product quality. Precision measurement and control remove any chance of error or guesswork in critical processes.
- Modern Honeywell instrumentation makes cost accounting more accurate than ever before. Everything is a matter of record.

An investment that really pays off

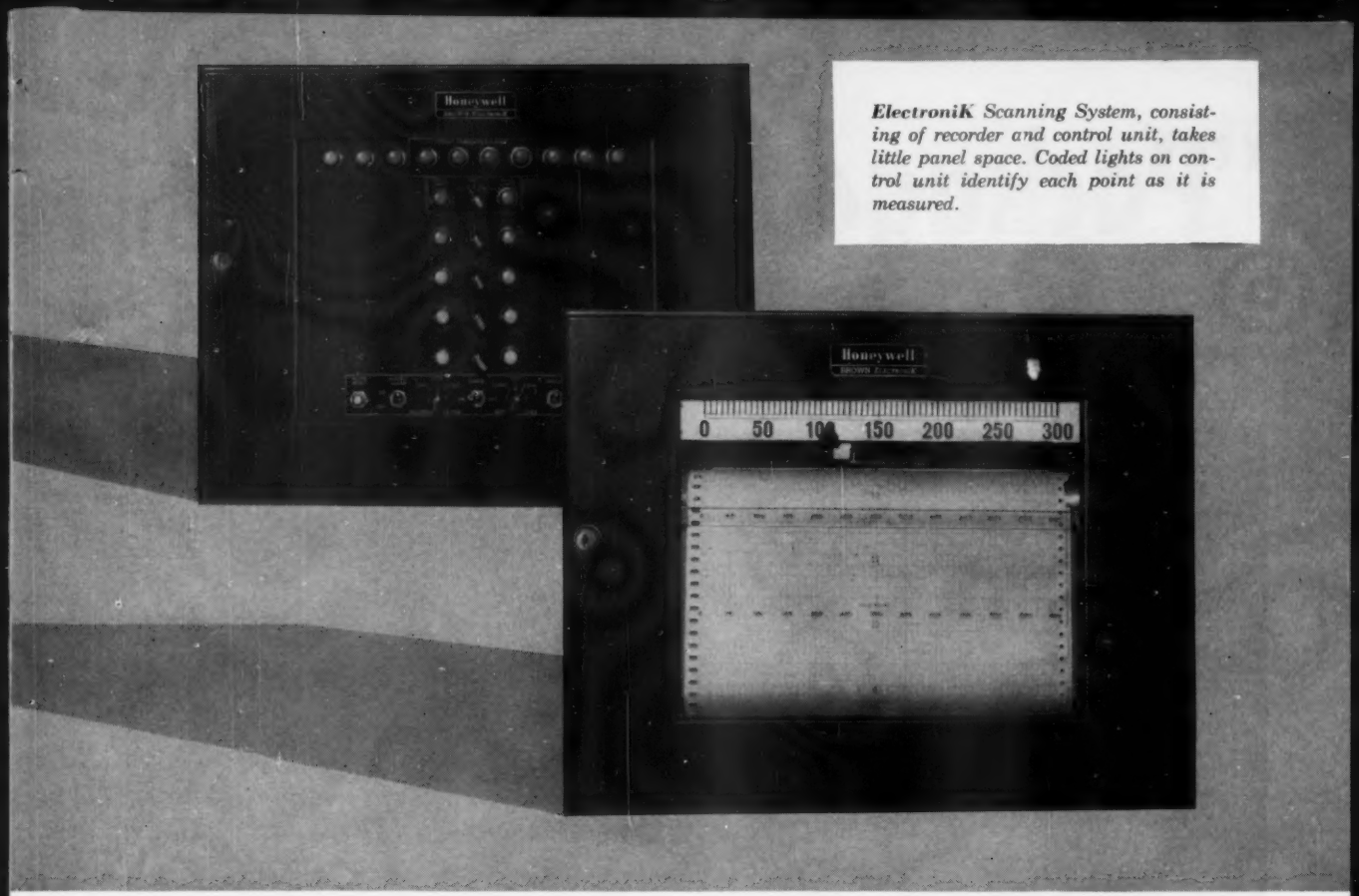
Just being "instrumented" is not enough. You can get more out of your instrument dollar, from both a product and service standpoint, with Honeywell instrumentation . . . the ultimate in engineering and design . . . insurance for your equipment investment.

Replacing with Honeywell is one of the best ways to invest your modernization appropriation. A Honeywell application engineer will gladly survey your present plant instrumentation . . . give you a practical recommendation that will make dollars and sense. Give him a call . . . he's as near as your phone.

This economical, versatile system monitors up to



Sample chart shows how all 270 points are clearly identified on the record.



ElectroniK Scanning System, consisting of recorder and control unit, takes little panel space. Coded lights on control unit identify each point as it is measured.

270 plant temperatures

THE TIME, expense and uncertainties of periodic tours to check temperatures at potential "hot spots" in the plant can be materially reduced by the *ElectroniK* Scanning System. This instrumentation makes temperature monitoring completely automatic and efficiently centralized. A single instrument watches 270 different temperatures in bearings, oil lines, boiler tubes, pumps . . . anywhere you can install a thermocouple.

Because of its exceptionally large capacity, the *ElectroniK* Scanner does the work of up to 16 old-style instruments . . . affords effective overheat protection at low cost per point.

It's fast—scans through successive thermocouples at speeds up to one second per point. Each point is checked at 4½ minute intervals . . . far more frequent than the best manual checks.

It signals overheat. Annunciator contacts are actuated whenever any point in a bank of nine exceeds a preset limit. Different limits can be set for each bank.

It's versatile. At the flick of a switch, the operator can choose:

1. Continuous recording of all 270 points, with positive identification of each.
2. Recording of only those points which exceed a preset limit.
3. Continuous scanning without recording.
4. Selective recording or scanning of pairs of nine-point banks.

Models with less than 270 points are available to meet your individual needs. Your nearby Honeywell sales engineer will be glad to discuss your own plant's requirements . . . and he's as near as your phone.

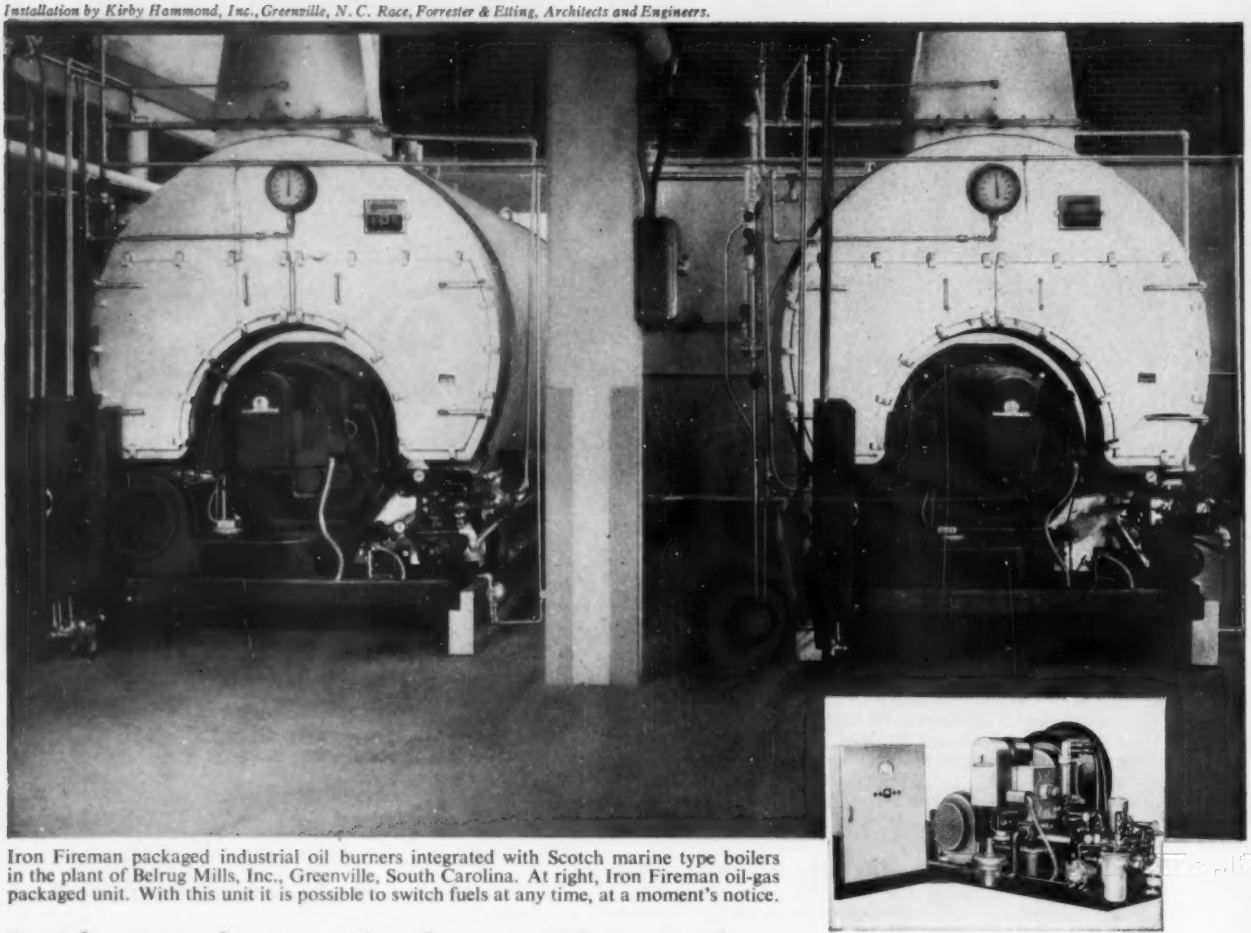
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

● **REFERENCE DATA: Write for Data Sheet No. 10.0-9, "*ElectroniK* Scanning System."**

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

"Packaged" for better firing at lower cost

Installation by Kirby Hammond, Inc., Greenville, N. C. Race, Forrester & Elting, Architects and Engineers.



Iron Fireman packaged industrial oil burners integrated with Scotch marine type boilers in the plant of Belrug Mills, Inc., Greenville, South Carolina. At right, Iron Fireman oil-gas packaged unit. With this unit it is possible to switch fuels at any time, at a moment's notice.

Engineered as a single complete unit

This Iron Fireman package unit is much more than a conversion burner. It's a complete combustion system in which all elements are correctly balanced and integrated—a thoroughly engineered firing plant. It includes burner (for oil or gas or both), fuel system, forced draft air supply, control panel, and pre-formed refractory combustion throat. Installation requires little more than bolting the entire unit to the boiler front and making service connections for power and fuel.

To the user this means an attractive saving in installation time and cost. But even more important, it means a factory assembled and tested unit instead of a locally assembled job. It means dependable performance and high operating efficiency, with substantial fuel savings. It's the *smart* way to modernize your boiler room.

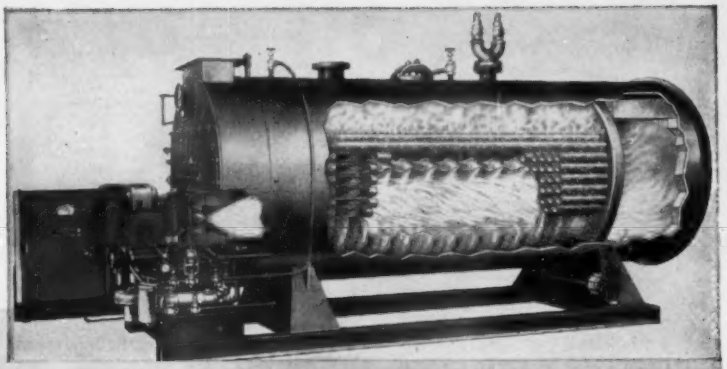
Get in touch with your Iron Fireman dealer, or mail the coupon on the opposite page for complete information.

THE IRON FIREMAN

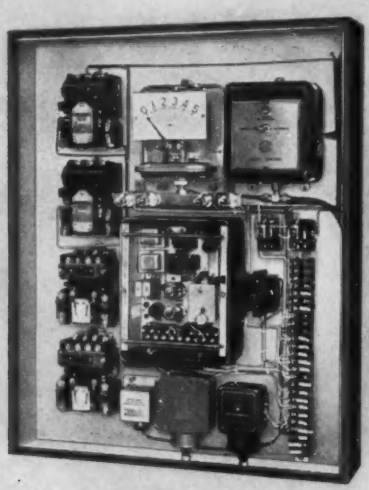
® Iron

OIL, GAS AND COAL FIRING

OIL, GAS or OIL-GAS COMBINATION BURNER UNIT BY IRON FIREMAN



Cutaway view of packaged boiler-burner unit consisting of Scotch marine boiler with Iron Fireman combination Gas-Oil forced draft burner. The shift from one fuel to another is accomplished quickly, with no sacrifice in firing efficiency.

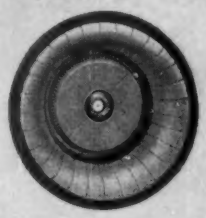


WIRED, TESTED CONTROL PANEL

Control panel is totally enclosed, with all instruments wired and tested at the factory. Entire wiring system is coded, with varicolored wires and numbered terminal strip inside panel. An indicating meter on the panel door shows the condition of the control system at all times. Indicating lights on panel front show operating status of unit at a glance. Green lights show motors in service; red indicates safety lockout.

IRON FIREMAN ROTARY OIL BURNER

The oil firing unit is the Iron Fireman rotary cup oil burner which has an outstanding record of reliability in precision firing of hard-to-handle heavy oils. Heart of the oil control system is the Iron Fireman Oil Volumeter, a variable volume metering pump submerged in the oil reservoir, which delivers the correct volume of oil to the burner head with extreme accuracy, regardless of changes in oil viscosity. Burns any grade of oil, from lightest to heaviest, without special adjustment.



REFRACTORY COMBUSTION THROAT

The combustion throat, with preformed built-in refractory, is an integral part of the burner unit. Both primary and secondary air are admitted to the combustion chamber through this throat, eliminating the special brickwork required by the usual conversion burner and greatly improving the air-fuel mixture. Oil cup is in the center of the refractory disc, which also shields the gas jets against the radiant heat of the furnace. Adjustable inlet vanes control the shape and rotation of the flame to match the requirements of the firebox or firetube.

No divided responsibility

No separate contracts for (1) boiler setting (2) electrical wiring (3) oil heating equipment (4) automatic control system (5) forced draft system (6) boiler refractory.

You can install a complete new boiler plant quickly and economically by specifying an Iron Fireman packaged burner and a Scotch marine type boiler engineered specifically for use with this unit. Forced draft, no high stack required. Or you can install the Iron Fireman packaged burner in practically any type of existing boiler, with important savings in installation and operating costs.

How to specify

First, decide what fuel or fuels you want to use (oil, gas or oil-gas combination). Second, determine the load. Third, refer to table in Iron Fireman catalog or specifications for the correct size of burner and boiler for your job.

For more information use the coupon below.

Fireman

FOR HEATING, PROCESSING, POWER

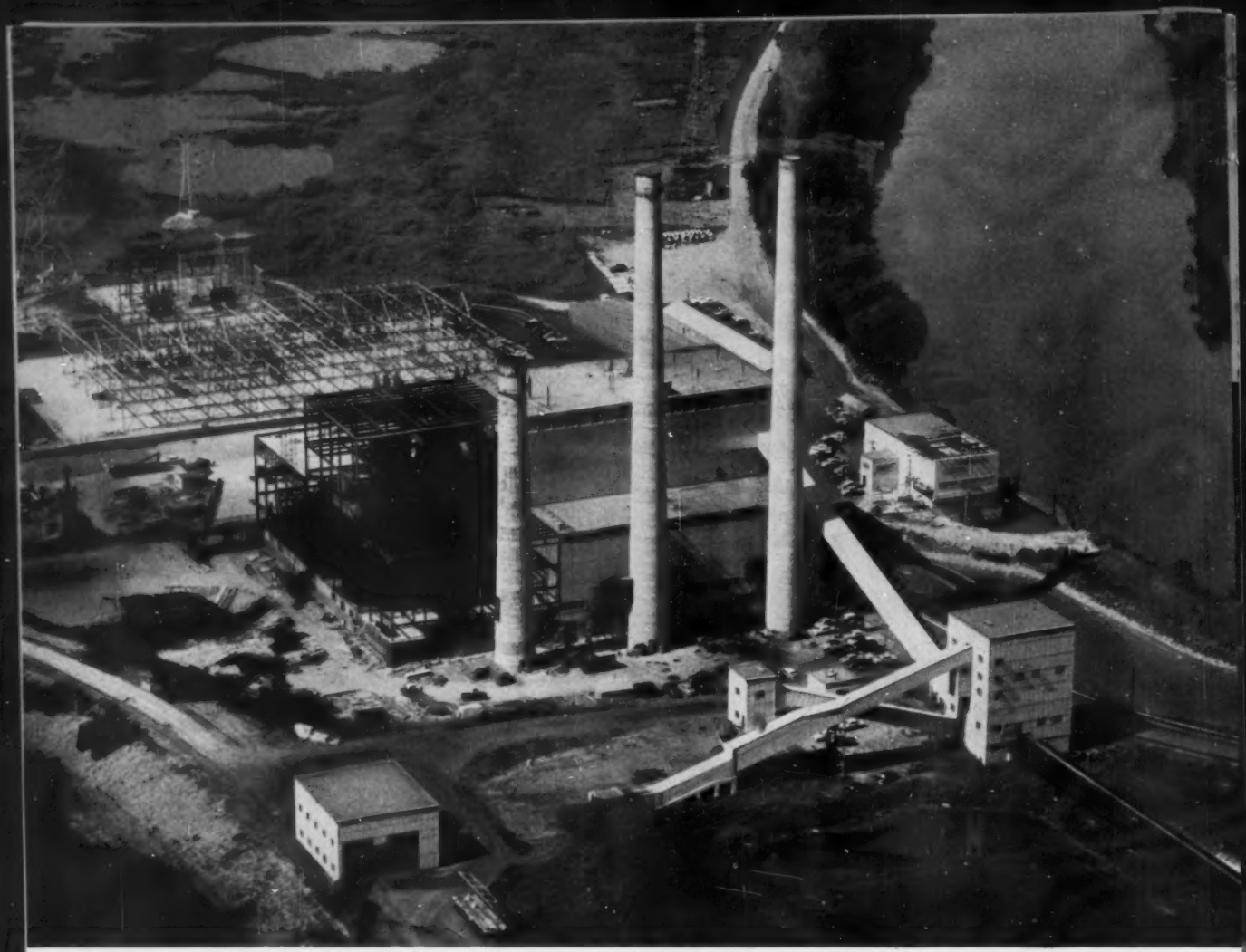
Iron Fireman Mfg. Co., 3048 West 106th Street, Cleveland 11, Ohio. In Canada, write 80 Ward Street. Toronto, Ontario.

Please send me literature giving full information on the Iron Fireman "packaged burner" unit.

Name _____

Address _____

City _____ *State* _____



Generating capacity of this plant is now 260,000 kw. Output goes into transmission system at 115 kv or 230 kv.

How New Upper Midwest Power Plant Assures Uninterrupted Power for Station Auxiliaries

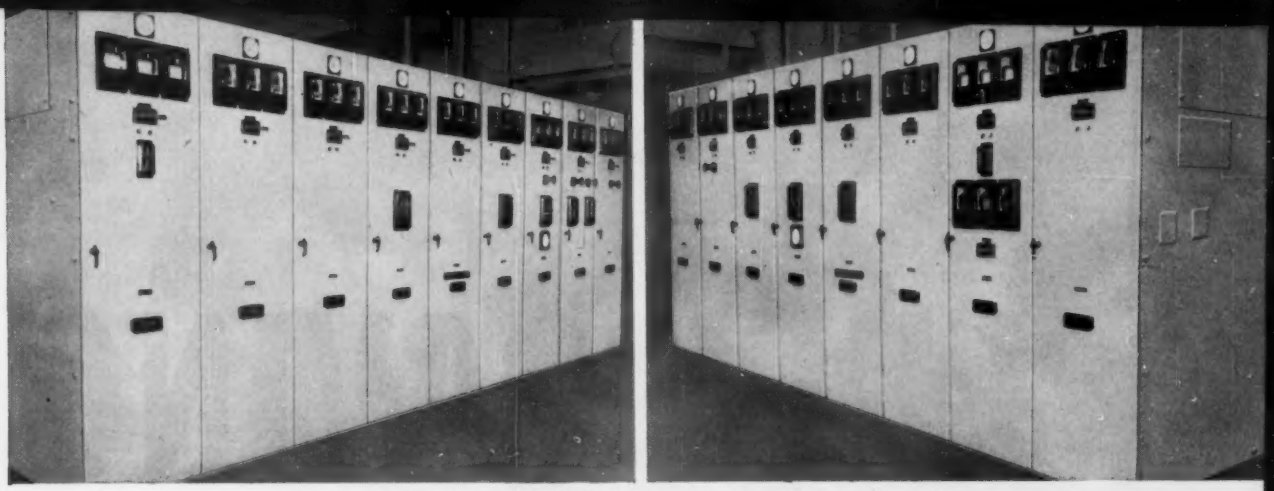
Installation Features Unit Auxiliary Buses in Two Sections With Automatic Emergency Transfer

Pioneer Service and Engineering Company in designing this plant decided on a manual make-before-break scheme on the throwover between the two sections of Allis-Chalmers switchgear. In this way they are sure the secondary source is cut in before cutting power from the primary source. A break-before-make automatic transfer is used in an emergency.

There is a house generator on the first unit only. It operates off the same shaft as the main generator, thus simplifying phasing problems. Operator is forced to use synchronizing switches, however, as a safety feature.

Auxiliary motors are protected by circuit breakers. To keep plant operating continuously, no overload

Progress In Switchgear **ALLIS-**



These two switchgear lineups face each other and are connected by bus shown at top. This group is one of three groups of Allis-Chalmers switchgear at this station.

tripping is used. An overload relay provides alarm on pulverizers and induced draft fan motors. Breakers trip only if there is a fault.

Two Switchgear Lineups

Two groups of Allis-Chalmers switchgear for each generating unit are provided along with duplicate auxiliaries. Each of these auxiliaries has excess capacity, so if one is shut down, the generating unit can still operate at two-thirds of full capacity.

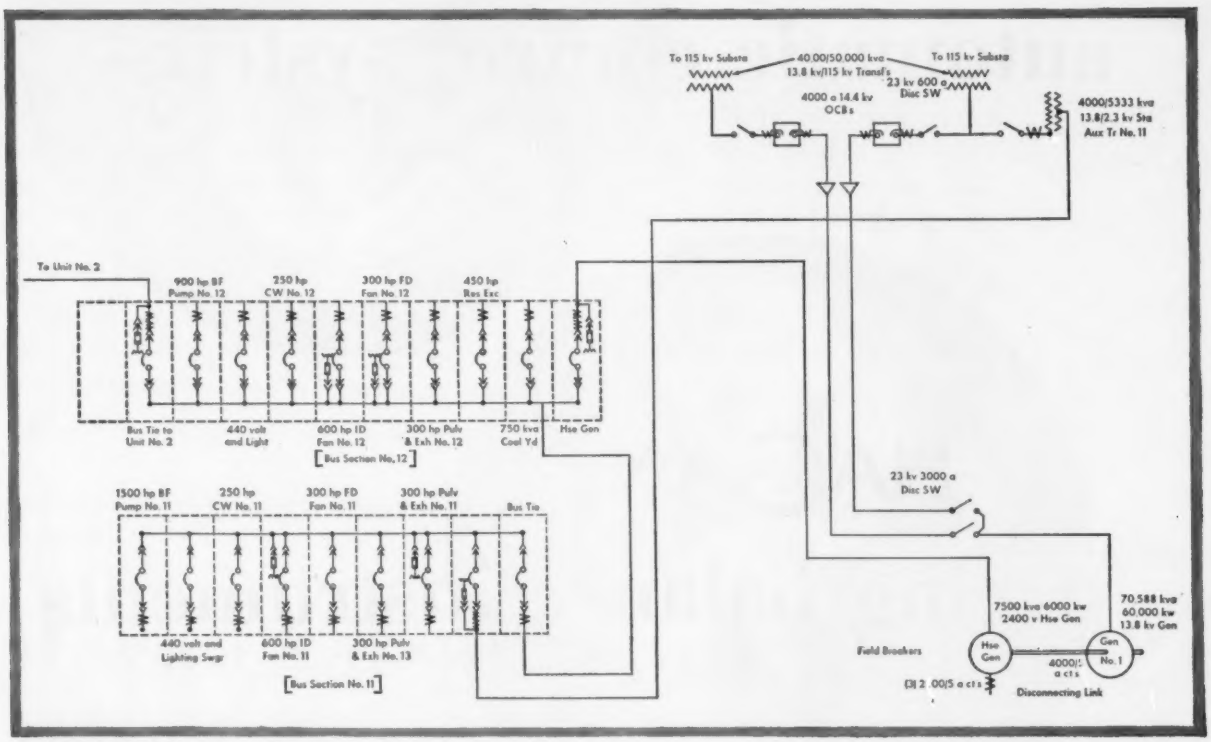
Both pulverized coal and natural gas can be used. These can be burned simultaneously in any desired proportion. This control is manual. Customary sequential interlocks in the switchgear are made with boiler control motors.

Both overload and short-circuit protection are provided by breakers on coal yard and miscellaneous circuits.

★ ★ ★

Allis-Chalmers engineers worked in close cooperation with Pioneer Service and Engineering Company and power company engineers on this interesting project. This is one of many auxiliary switchgear lineups built by Allis-Chalmers. For information, call your nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4449



Engineered by Pioneer Service and Engineering Company.

CHALMERS

A-C ALLIS-CHALMERS

FUEL SAVING
HAGAN
automatic control systems
HAGAN
ring balance instruments

is our business

The primary purposes of every installation of Hagan Automatic Combustion Control and Instrumentation are to save fuel, and to provide the indications and records which guide the operators in maintaining maximum efficiency.

Each component of a Hagan System is selected to perform a specific function accurately and dependably, and to coordinate smoothly with all other related components in the system.

Back of every system, irrespective of size, there are more than thirty-five years of experience in development, design and application of Automatic Combustion Control and Instrumentation. As a result, Hagan Systems are easy to install, easy to calibrate and easy to keep in topnotch operation.

These typical applications emphasize the versatility of Hagan equipment and Hagan methods:

- Automatic combustion control systems for boilers of any size and pressure, burning all types of fuels, singly or in multiple.
- Boiler drum water level control, with automatic correction available for such factors as boiler load and boiler water density.
- Automatic control of gas and air temperatures for air preheaters.
- Draft and pressure controls for a continuous range from high vacuum to 5000 psig.
- Superheated steam temperature control.
- Pressure and temperature controls for feedwater heaters.
- Recording, indicating and totalizing flows of liquids, vapors and gases. Interchangeable sensing elements are available for full scale differentials from 1″ to 560″ WC.
- Simultaneous records of two separate flows, measured in a single meter housing. Flows may be added or subtracted.
- Pressure and temperature compensated records of steam and gas flows.
- Density compensated records of liquid flow or level, or for gas flows.
- Pneumatic and electric signal transmitters.
- Flow ratio control for liquids and gases.

Our engineers will be glad to suggest the Automatic Control and Instrumentation to fit your requirements.

Hagan Corporation

HAGAN HALL BUROMIN CALGON

HAGAN BUILDING PITTSBURGH 30, PENNSYLVANIA

Boiler Combustion Control Systems • Ring Balance Flow and Pressure Instruments • Metallurgical Furnace Control Systems Control Systems for Automotive and Aeronautical Testing Facilities

PICK YOUR PACKAGE

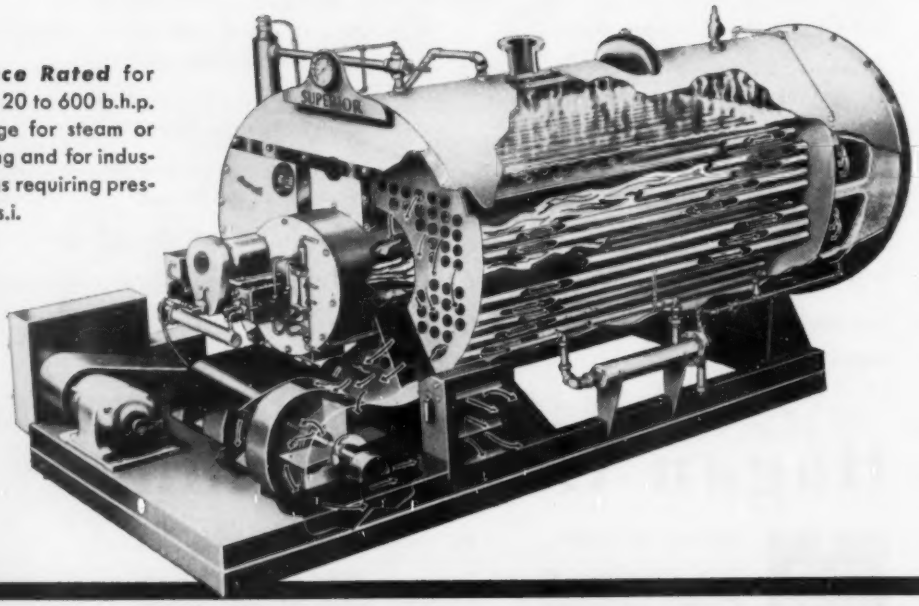
From the smallest 20 h.p. Fire Tube, up to the special 45,000 lbs. per hour Type D Water Tube unit, every Superior Steam Generator is "Performance Rated" for high efficiency operation and long life under actual conditions of service.

These "Performance Ratings" are based upon factory fire tests conducted on every Superior Steam Generator before shipment. When you buy a Superior Steam Generator, you buy results which are guaranteed by these tests . . . and you may witness the tests if you wish.

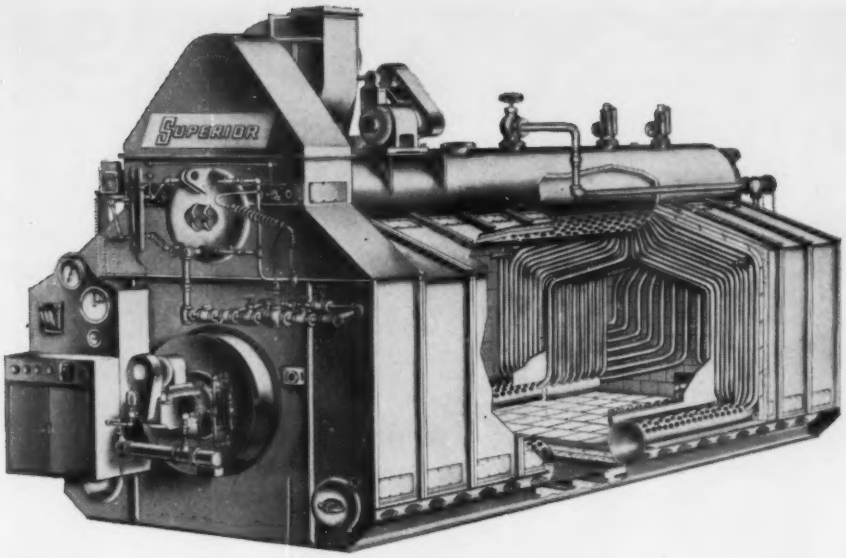
When you pick a packaged unit, pick a Superior packaged unit . . . it eliminates all of the guesswork. Built by Superior Combustion Industries, Inc., whose boiler division specializes in the *exclusive* manufacture of *packaged* steam generators, a Superior "Performance Rated" package is your guarantee of low-cost steam, minimum maintenance, and high availability.

from the PERFORMANCE

Performance Rated for capacities from 20 to 600 b.h.p. Pick this package for steam or hot water heating and for industrial applications requiring pressures to 250 p.s.i.

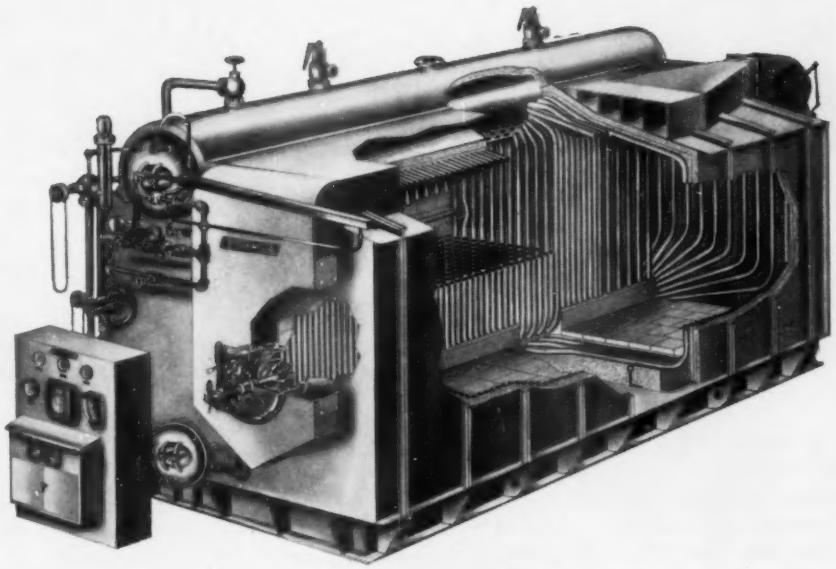


SUPERIOR COMBUSTION
TIMES TOWER, TIMES SQUARE,



Performance Rated for steam capacities from 12,000 to 38,000 lbs. per hr. at pressures from 100 p.s.i. Ideal for automatic installations in institutions and industry. For oil, gas, or coal firing, providing maximum versatility.

RATED Line

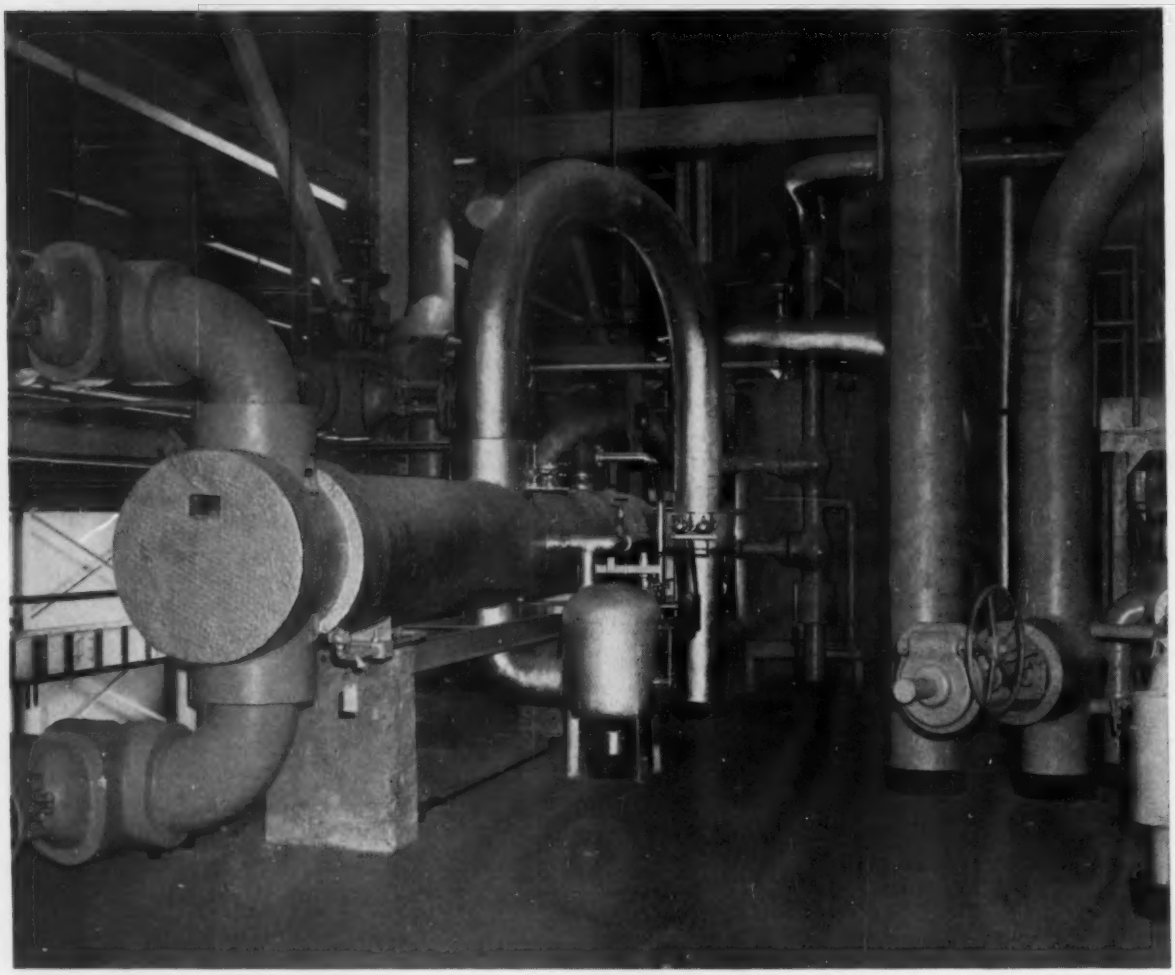


Performance Rated for industry. 8,000 to 40,000 lbs. per hr. Pressures from 100 to 900 p.s.i. Superheaters when required for final steam temperatures to 750°F. For firing oil or gas, with rear-mounted centrifugal fan for quiet operation and unobstructed firing front.

for performance you can ***BANK*** *on*

INDUSTRIES, INC.
NEW YORK 36, N.Y.

SUPERIOR
STEAM GENERATORS



This evaporator-condenser unit in a modern power plant is insulated with "Featherweight" 85% Magnesia.

"Featherweight" 85% Magnesia insulation conserves heat and dollars

"Featherweight" 85% Magnesia (85% basic carbonate of magnesia and asbestos fiber) effectively insulates piping and equipment with temperatures up to 600° F. Used with a primary layer of K&M Hy-Temp Insulation (Diatomaceous Silica), the combination is effective up to 1900° F. The application of these two layers—with staggered joints—eliminates the heat loss that normally occurs when expansion causes the joints to open in single layer installations.

These K&M insulations last the life of the equipment they serve. They withstand moisture, vibration and frequent temperature changes.

New and now available is "Featherweight" Water-Resistant Magnesia Insulation for temperatures up to 450° F. It is used underground where severe water exposure may damage the insulation or on indoor steam heated lines and equipment where high humidity and moisture are present.

For more information on these heat-saving, money-saving K&M insulations, contact your K&M distributor who is an experienced applicator. Or write directly to us.

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Nature made asbestos . . . Keasbey & Mattison has made it serve mankind since 1873

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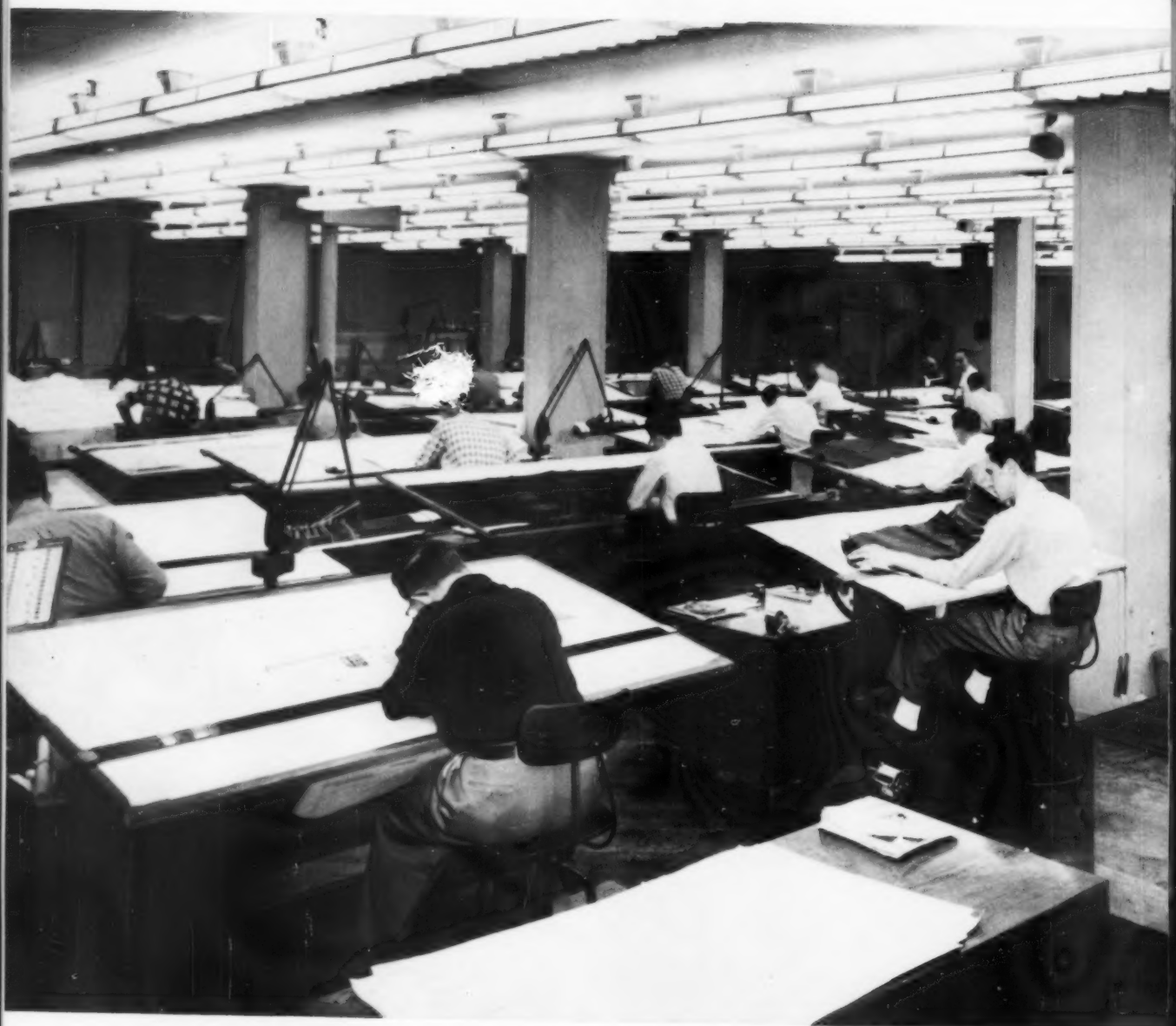
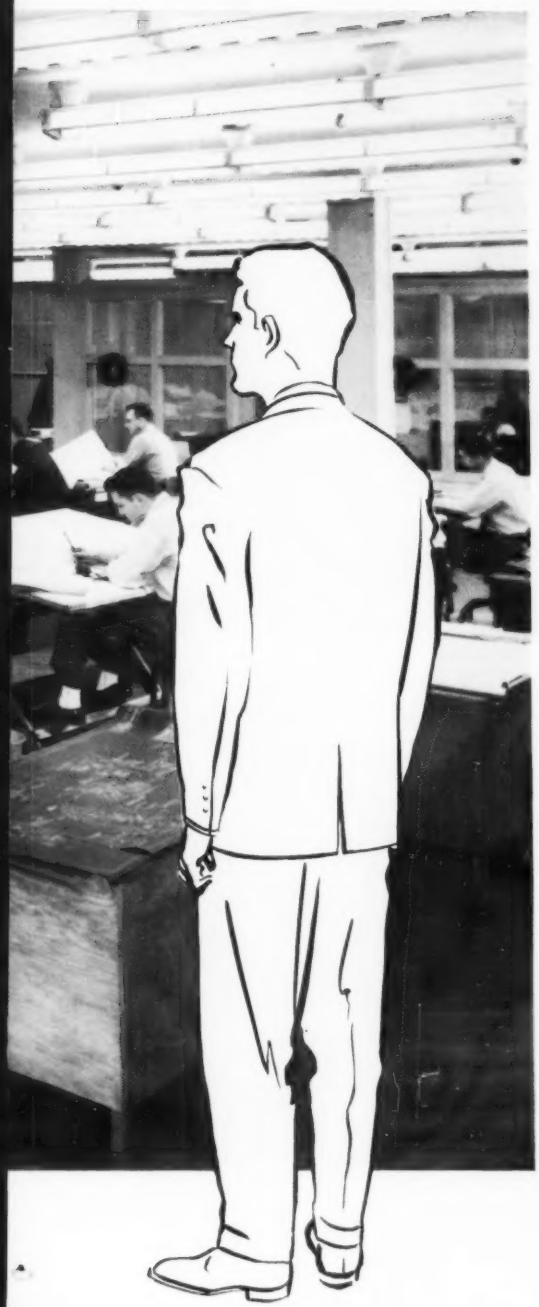
VULCAN
We believe
ONLY THE HIGHEST QUALITY OF PRODUCT AND SERVICE TO OUR CUSTOMERS CAN BUILD A REPUTATION WORTHY OF OUR EFFORT.
Copes-Vulcan



YOU ARE IN OUR ENGINEERING DRAFTING ROOM



"There's more here than meets your eye!"

Here you see Copes-Vulcan Engineering in action—men at the boards, working under ideal conditions. Unseen are the Copes-Vulcan engineers who create ideas. Together they make up a lively team—another reason why Copes-Vulcan products work so dependably on your boilers.

We are not bound by tradition. Our half-century of engineering experience is blended well with fresh, new thinking.

Engineering is vital at Copes-Vulcan. It helps us live up to our code that "only the best is worthy of our combined efforts."

COPES VULCAN

COPES-VULCAN DIVISION

CONTINENTAL FOUNDRY & MACHINE COMPANY

CONTROLS AND MECHANICAL CLEANING FOR BOILERS

ERIE 4, PENNSYLVANIA

COPES VOLCAN

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...ilding for POWER PLANTS

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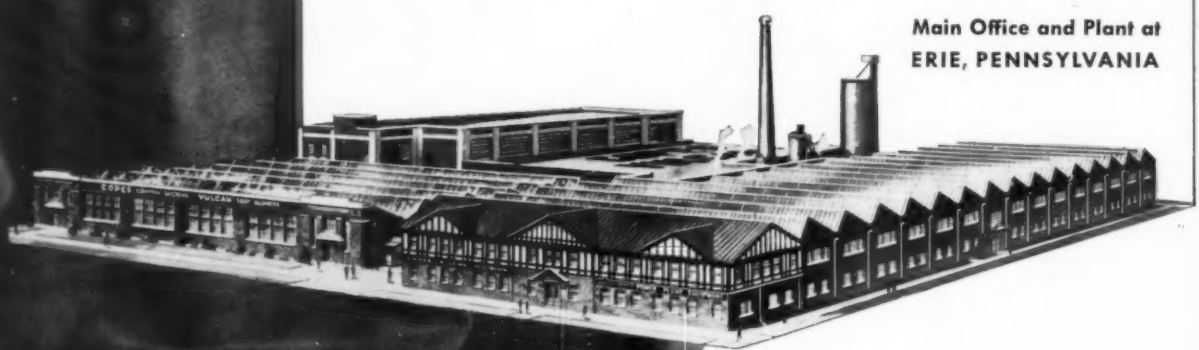
Main Office and Plant at ERIE, PENNSYLVANIA



The New S·E·CO. Coal Valve
Can Eliminate Your Coal Valve Headaches

FOR EXAMPLE . . . it has *self-cleaning,* coined, ladder racks that cannot become clogged with coal, even on jobs having internal pressure. This feature alone can eliminate hours of time spent cleaning coal from the valve body, racks and pinions so that you can operate it.

. . . the pinions are also of *self-cleaning* design, located *above* the gate, an exclusive S-E-Co. design feature. This position helps keep the ladder racks clean and assures positive tooth engagement. This, together with the new husky sized racks, can eliminate your troubles with tooth breakage and subsequent time consuming repairs.

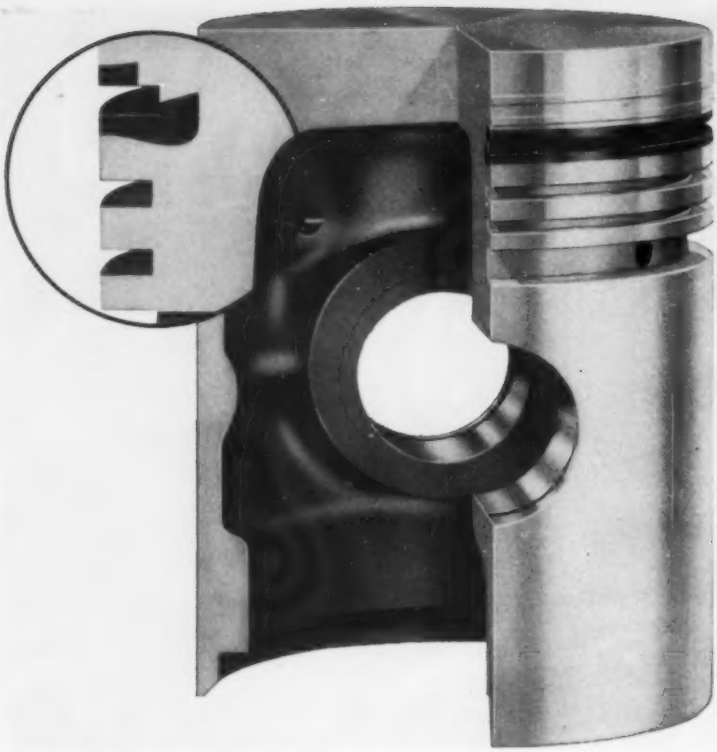
. . . large, 2-5/16" diameter, rollers, equipped with ball bearings, support the gate making sure it will move easily. These rollers have stainless steel shells to combat corrosion. Felt grease seals and stainless steel grease retainers with fittings for pressure lubrication insure their long life.

Dependability, minimum maintenance requirements and ease of operation are built into each S-E-Co. Coal Valve. Write for our new Bulletin #97 or for a local representative to call and assist you select valves to replace those that are not giving satisfactory service.

SPECIALISTS IN
BUNKER TO PULVERIZER AND
BUNKER TO STOKER EQUIPMENT

STOCK Equipment Company

745-P HANNA BLDG., CLEVELAND 15, OHIO



Ni-Resist is Bonded In . . .
permanently by both the Al-Fin process and the exclusive Zollner mechanical lock . . . to make separation impossible. Mileage between overhauls is greatly increased due to control of wear, burning and erosion in the ring area. This BOND-O-LOC piston was developed by Zollner Machine Works, Fort Wayne, Indiana.

Zollner reports
5 times more mileage is typical
with top ring sections of
Ni-Resist

"Extra Heavy Duty" accurately describes the service for which Zollner designed this piston . . .

Because Ni-Resist® eliminates wear troubles in the top ring groove.

Records prove that gasoline or Diesel engines which use aluminum alloy pistons with top ring bands of Ni-Resist, show a step-up in power and greatly improved piston life, as well as lower maintenance. The reason for this is clear.

Ni-Resist resists heat, corrosion, metal-to-metal wear and galling. By controlling ring groove wear, it stops unnecessary oil consumption and needless loss of power due to "blow by."

In addition . . . despite high piston temperatures . . . there's no joint failure because the thermal expansion of Ni-Resist closely matches that of the aluminum alloy.

Current practice of increasing engine output by using chemically treated fuels and higher operating temperatures, emphasizes the need for Ni-Resist bands in aluminum pistons, whether the engine is for truck, bus, locomotive, marine, aircraft, or stationary power plant use.

It pays to use Ni-Resist for other engine applications, also, such as exhaust valve guides, cylinder liners, exhaust manifolds, connector rings, exhaust seat rings and ball joints, water pump impellers and bodies. Insist on Ni-Resist in original equipment or replacement parts.

No other cast metal provides such a useful combination of engineering properties . . .

Several types of Ni-Resist are available to meet a variety of industrial demands. Get full information . . . mail the coupon now.

INCO TRADE MARK

The International Nickel Company, Inc.
67 Wall Street, New York 5, N. Y.

Please send me booklets entitled "Engineering Properties and Applications of Ni-Resist" and "Buyers Guide for Ni-Resist Castings."

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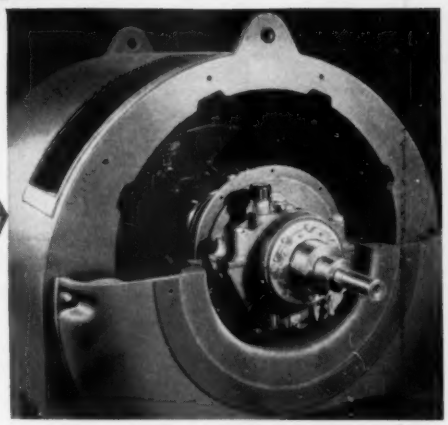
new DESIGN...

more protection with full accessibility



* New Allis-Chalmers slip-ring motor with inspection cover and upper half of end shield removed. Note accessibility of brushes, protection of bearing.

ALLIS-CHALMERS LARGE SIZE SYNCHRONOUS AND WOUND-ROTOR MOTORS have been completely redesigned with longer stator yokes and shorter end shields. Collectors and brushes are located inside the yoke for protection against physical damage, dripping moisture, dust and dirt.

Capsule-type bearings give better bearing protection, too. The upper half of the end shield may be removed for inspection or cleaning of the interior of the motor without disturbing the exciter or exposing the bearing to the ravages of dirt, dust and oil contamination.

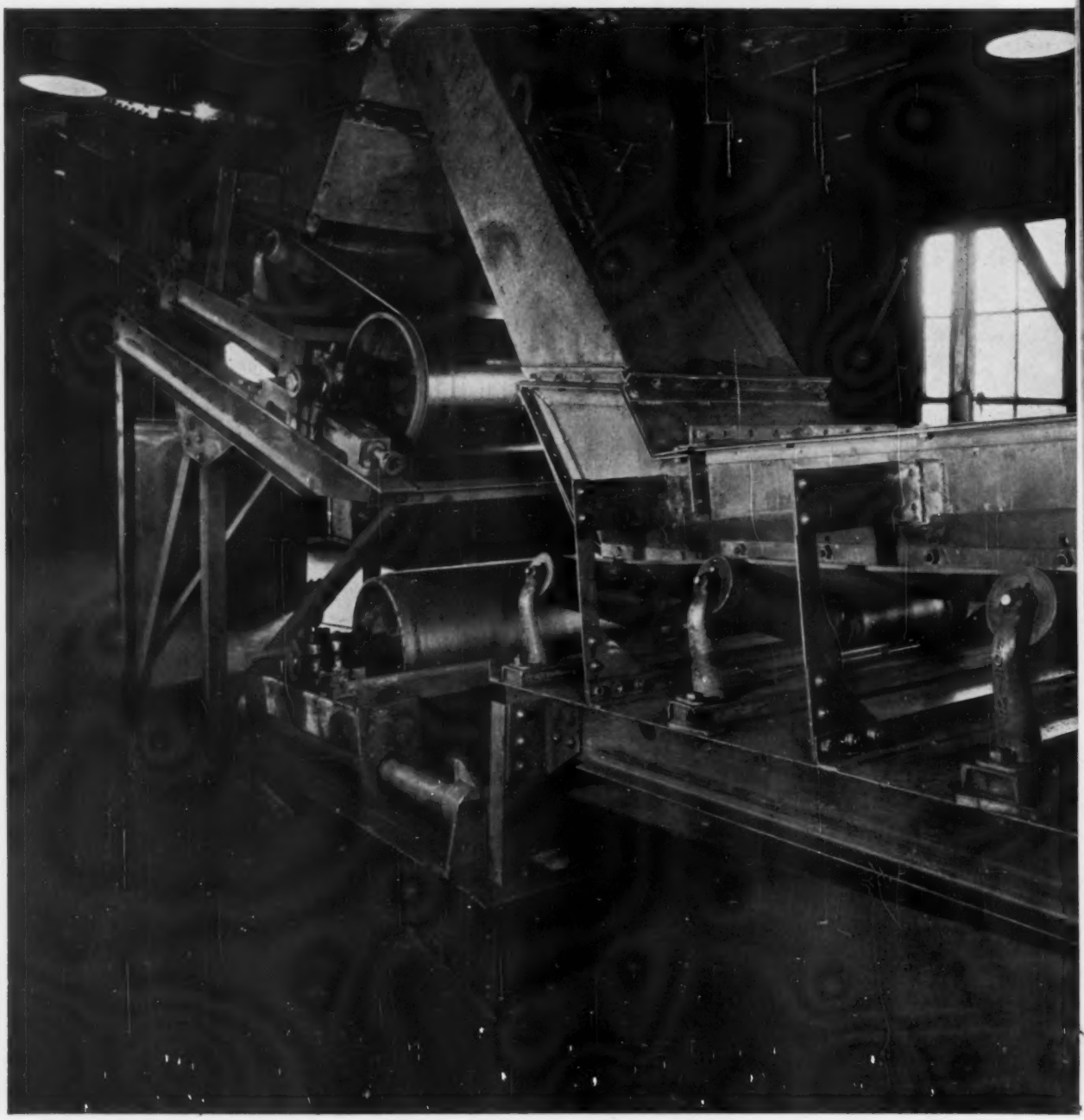
All leads enclosed — Both primary and secondary winding leads are brought out through separate conduit boxes. There is no loose wiring . . . no exposed leads anywhere.

Easy maintenance — Even though the new design offers maximum protection to brushes and collectors, internal parts are fully accessible for inspection and maintenance through large openings in the stator yoke. Opening covers are readily removed and are secured during operation by easy-operating, self-locking fasteners.

Get details now — This new design is available from approximately 250 hp at 300 rpm and up, in drip-proof and splash-proof construction. Call your Allis-Chalmers representative for complete details or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 05R8183. A-4464

ALLIS-CHALMERS

14 Years Dependable



HEWITT-ROBINS

EXECUTIVE OFFICES, STAMFORD, CONNECTICUT

Coal Handling Service

Customer's Performance Record

LOCATION: Cliffside Steam Station of Duke Power Company, Cliffside, North Carolina.

EQUIPMENT: Complete system for the unloading, crushing and storage of coal. It includes two Hewitt-Robins HD Car Shakeouts, four Hewitt-Robins Shaking Feeders, six Hewitt-Robins Belt Conveyors in series, coal breaker, weightometer and miscellaneous equipment.

OPERATION: Daily handling of coal from hopper cars through crusher directly into boiler room bunkers, or to the initial pile of the outdoor storage area.

PERFORMANCE: Coal is unloaded from hopper cars by Car Shakeouts directly into under-track hoppers. Feeders deliver coal from hoppers onto belt conveyor system that carries coal to crusher. From crusher coal flows directly by conveyor into boiler room bunkers or to outdoor storage area. System is also designed to permit reclaiming of coal from storage area into power house bunkers.

RESULTS: During the 14 years that this complete coal handling system has been in operation it has provided daily service and has handled a total of 6,526,065* tons of coal with the normal and expected amount of maintenance.

*Total coal handled through June 30, 1954

ENGINEERING DATA

TYPES: Six 36" wide Conveyors mounted on steel structures.

SPEED & CAPACITY: Belt speed of 260 to 300 FPM, carrying capacity 300 TPH of coal @ 50#1 cu. ft. up to 6" lumps.

IDLERS: Robins style S-25 troughers and Robins style S-35 returns.

BELTS: Two Ajax type belts, totalling 398'; four Conservo type totalling 735'.

HORSEPOWER: Six conveyors use total of 78 horsepower.

Here is a partial list of
HEWITT-ROBINS PRODUCTS
that will help you cut handling costs and increase operating efficiency.

MACHINERY

Belt Conveyors
Belt & Bucket Elevators
Car Shakeouts
Conveyor Idlers
Dewaterizers
Mechanical Feeders
Foundry Shakeouts
Mine Conveyors
Reclaiming Systems
Screen Cloth
Stackers & Trippers
Vibrating Conveyors & Screens

INDUSTRIAL RUBBER PRODUCTS

BELTING:
Conveyor
Elevator
Transmission

HOSE:
Acid
Air & Air Drill
Barge Loading
Dust Suction
Fire
Fuel Oil & Gasoline
Gasoline Pump
Mud Pump Suction
Oil Suction & Discharge
Propane-Butane
Road Builders'
Rotary Drilling
Sand Blast
Sand Suction
Sea Loading
Servall®, All-Service
Steam
Tank Car & Tank Truck
Vacuum & Air Brake
Water & Water Suction
Welding, Twin-Weld®

MOLDED RUBBER PRODUCTS

•

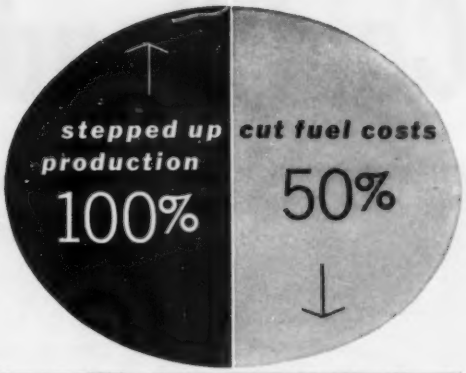
For information and service on industrial rubber products, contact your Hewitt-Robins Industrial Supply Distributor. Through his complete stock of Hewitt-Robins Rubber Products, and his familiarity with local field conditions, he can fill your supply needs promptly and correctly. See Classified Phone Book for the Hewitt-Robins Industrial Supply Distributor serving your area.

4514

INCORPORATED

DOMESTIC DIVISIONS: Hewitt Rubber • Robins Conveyors • Robins Engineers • Restfoam
FOREIGN SUBSIDIARIES: Hewitt-Robins (Canada) Ltd., Montreal • Hewitt-Robins Internationale, Paris, France • Robins Conveyors (S. A.) Ltd., Johannesburg • **EXPORT DEPARTMENT:** New York City.

How a KEWANEE Reserve Plus Rated boiler...



Duracrete Block Company, Inc., Hooksett, New Hampshire

■ Anyone would find it difficult to prove to Dante V. Donati, Manchester, New Hampshire, that Kewanee Reserve Plus Rated Boilers do not pay dividends. That's because he discovered it the hard way. First, he bought an ordinary boiler for his plant at the Duracrete Block Company. He operated it one year, and then . . . but let him tell the story—

"We installed an ordinary boiler and found it to be inadequate. We then purchased a Kewanee Unit. Our production was stepped up more than 100% . . . with fuel costs cut in half. Maintenance cost is extremely low. The quality of our product has improved because of lower moisture content due to ample steam for processing."

Judging from Mr. Donati's experience it just makes sense that it's money in the bank to follow the Kewanee Reserve Plus Rating Plan in selecting a boiler. So when you choose a boiler, know these important facts:

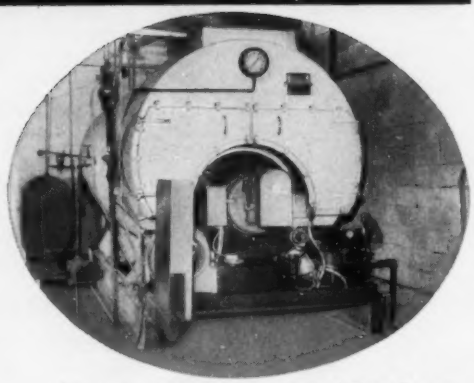
1—*Boiler rating must be based on nominal capacity, not maximum capacity;*

2—*Boilers must have sufficient built-in reserve to meet changing demands;*

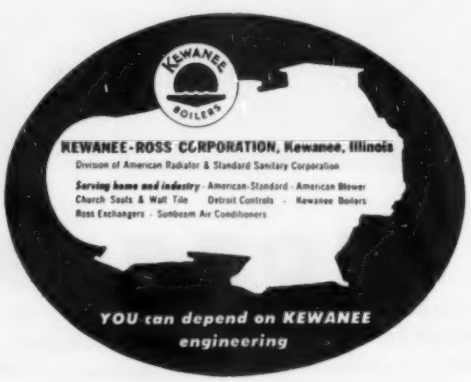
3—*Boilers must have sufficient capacity to operate at "cruising speed," not maximum speed at all times;*

4—*Like examples must be considered in comparing boilers. Don't be confused by vague technical claims.*

Choose Kewanee and cut fuel costs—lower maintenance—reduce breakdowns—get longer boiler life.



Here is No. 85-60 Kewanee Oil Fired Boiler-Burner Unit installed at the Duracrete Block Company.


KEWANEE BOILERS
KEWANEE-ROSS CORPORATION, Kewanee, Illinois
Division of American Radiator & Standard Sanitary Corporation
Serving home and industry · American-Standard · American Blower
Church Seats & Wall Tile · Detroit Controls · Kewanee Boilers
Ross Exchangers · Sunbeam Air Conditioners
YOU can depend on KEWANEE engineering

Here's Help in Understanding STEAM-WATER CYCLE ANALYSES

OFTEN, constituents of deposits in steam-water cycles are reported to you in mineral names rather than chemical formulas. To help you better understand reports and analyses with these names, Allis-Chalmers has published a new Informational Bulletin, Number 59. It lists each mineral, then gives the chemical formula, the usual area in which these deposits are found, and the causes and possible preventive measures you can take.

Part of Practical Library

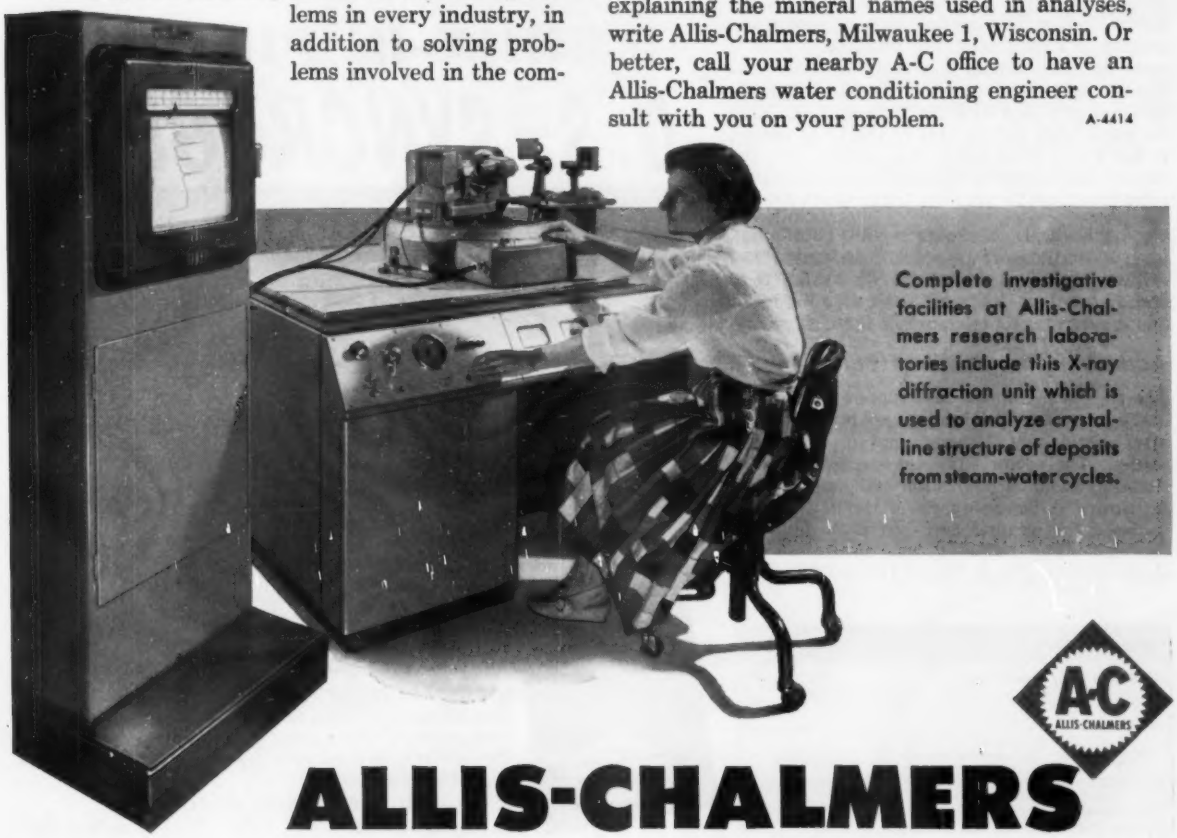
Only careful analysis of all the factors in the cycle can solve a specific water problem. This bulletin will help you understand, generally, the causes and solutions of a variety of water problems. It is one of a series published by Allis-Chalmers. These bulletins reflect Allis-Chalmers wide experience from years of solving water problems in every industry, in addition to solving problems involved in the company's own broad line of power plant equipment.

ALLIS-CHALMERS WATER CONDITIONING
Equipment — Chemicals — Service

Complete Water Conditioning Service

Allis-Chalmers offers complete water conditioning service. You can get analyses and reports on your problems. You can get chemicals needed for water treatment. And you can get the equipment needed for any system.

For your copy of Informational Bulletin 59 explaining the mineral names used in analyses, write Allis-Chalmers, Milwaukee 1, Wisconsin. Or better, call your nearby A-C office to have an Allis-Chalmers water conditioning engineer consult with you on your problem. A-4414



Complete investigative facilities at Allis-Chalmers research laboratories include this X-ray diffraction unit which is used to analyze crystalline structure of deposits from steam-water cycles.

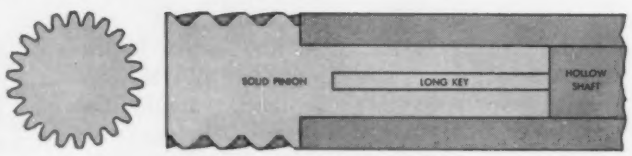
A-C ALLIS-CHALMERS

ALLIS-CHALMERS

In your opinion, which pinion?

. . . for longest life in a gearmotor

ORDINARY SHELL TYPE PINION



U. S. SOLID TYPE PINION

In an internally geared motor the pinion on the motor shaft is the vital link between motor and gearing. It's the fastest, but smallest gear, so it must be extra strong, free from vibration and forever tight. Now compare the U. S. Syncrogear motor pinion with the ordinary type. Note the extra large section area of the U. S. design. It has a long solid shank that anchors into the motor's hollow shaft, whereas the ordinary shell type has a small section area, short keyed.

Obviously the U. S. design is most substantial, longer lasting, more resistant to deflection and can carry high speed loads far more safely than common designs. All the gears are deep-hardened and shaved to exact tolerances in the U. S. plants.

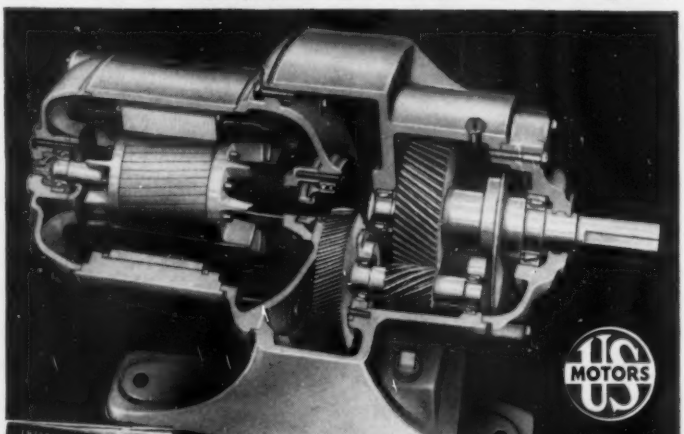
Added life lengthening features

The rugged pyramidal case supports the motor and gear train and all castings are normalized to insure permanent alignment and to prevent distortion. The motor windings are asbestos-protected to avoid carbonization and guard against burnouts. All moving parts are completely enclosed for weather and dust protection and confined within the least cubical dimensions on a single mounting. ¼ to 30 h.p.; 10 to 10,000 r.p.m.

THE ONLY MOTOR WITH A

BUILT-IN PINION

U. S. SYNCROGEAR



***FREE* 16-PAGE DESCRIPTIVE BOOKLET GIVES ALL THE FACTS**

Interesting multi-colored Booklet presents engineering facts you should know about geared motors, and illustrates the various U. S. Syncrogear types. Mail the Coupon for a copy. No obligation.

U. S. ELECTRICAL MOTORS Inc.

Los Angeles 54, Calif. **Milford, Conn.**

U. S. Electrical Motors Inc. P-13
Box 2058, Los Angeles 54, Calif. or Milford, Conn.

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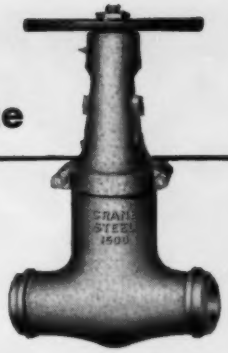
for high-pressure high-temperature service



here's what you get in

CRANE PRESSURE-SEAL BONNET VALVES

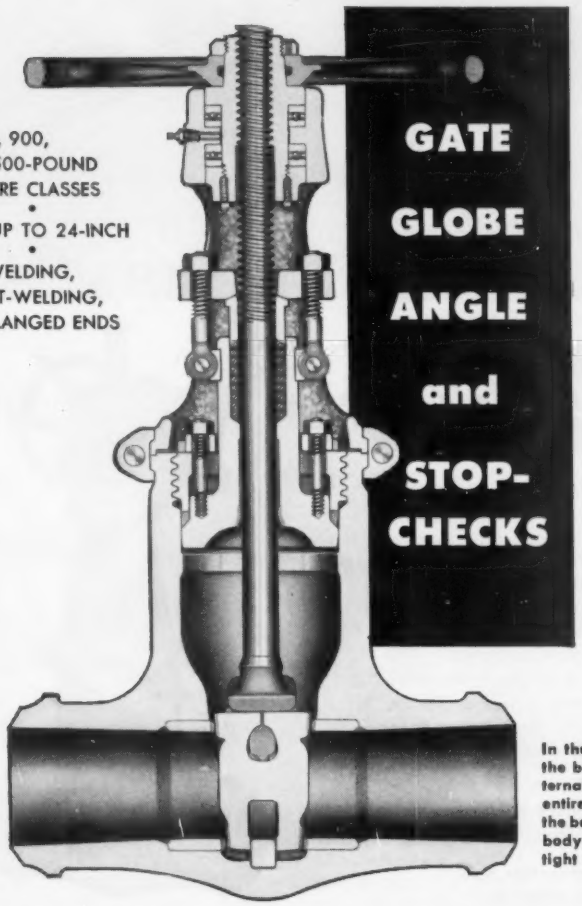
IN 600, 900, AND 1500-POUND PRESSURE CLASSES

•

SIZES UP TO 24-INCH

•

BUTT-WELDING, SOCKET-WELDING, AND FLANGED ENDS



NO BONNET-JOINT LEAKAGE

. . . and therefore no bonnet-joint maintenance. Crane design utilizes internal fluid pressure to form a pressure-tight metal-to-metal joint.

SAVINGS IN WEIGHT AND SPACE

. . . up to 60% over conventional valves. Crane streamlined valve shape also minimizes service strains and stresses. Handling in erection and maintenance is easier. You can save on piping suspension, too.

STRAIGHT-THROUGH FLOW

. . . in gate valves, resistance to flow is minimized because inner diameter of body seat rings and inside surface of disc guide are in line. Globes and stop-checks also have excellent flow characteristics.

SMOOTH, EASY OPERATION

. . . for instance, in larger size gate valves, a flexible wedge disc prevents sticking . . . is not "pinched" in the valve body by contraction as the result of cooling . . . requires minimum torque to open.

CRANE QUALITY THROUGHOUT

. . . depending on service requirements, bonnet and body are Crane Carbon-Molybdenum or Chrome-Molybdenum Alloy Steels. All seating surfaces are long-lasting Stellite. Body seat rings are accurately fitted and welded, and cannot loosen in service.

Get better acquainted with this modern Crane line—ask your Crane Representative for a copy of folder AD1936, or write direct.

In the cross-section you can see how the bonnet-joint is *inside* the valve. Internal fluid pressure, acting upon the entire underside of the bonnet, forces the bonnet against the seal ring between body and bonnet, forming a pressure-tight metal-to-metal joint.

THE BETTER QUALITY . . . BIGGER VALUE LINE . . . IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

Only 60 Seconds

To open a 24" gate valve

...instead of 12 to 15 minutes

with **Limitorque**

Think of the saving in man hours that could be effected in a year's time by the use of LimiTorque—not to mention the elimination of key men climbing to out-of-the-way, often times hazardous locations of important valves . . . Then too, when LimiTorque opens or closes valves, by the "*mere push of a button,*" the valves are operated at just the correct speed . . . and if an obstruction is encountered in closing, LimiTorque shuts off the motor, thereby preventing any possible damage to the valve seats, stems, discs or gates.

LimiTorque is operating thousands of valves throughout the World . . . day and night, on land and sea, in hot and sub-zero climates, indoors and outdoors . . . *Speedily—Safely—*and *Dependably.* LimiTorque Motor Operated Valves are readily adapted to Micro-wave Control.

Send for catalog L-54—and remember, *far more valves are operated by* LimiTorque than any other valve control.

See us at Booth 539 "Power Show" Convention Hall, Philadelphia—December 2nd to 7th inclusive.

Philadelphia Gear Works, INC.

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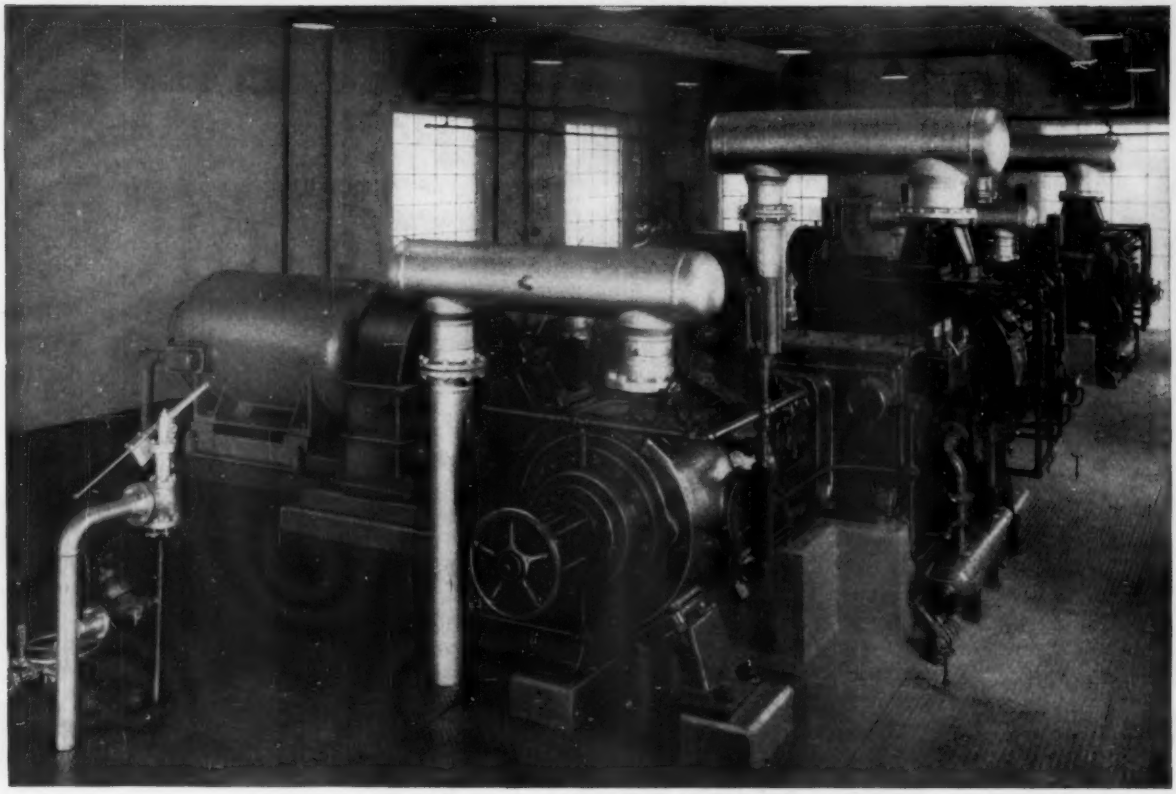
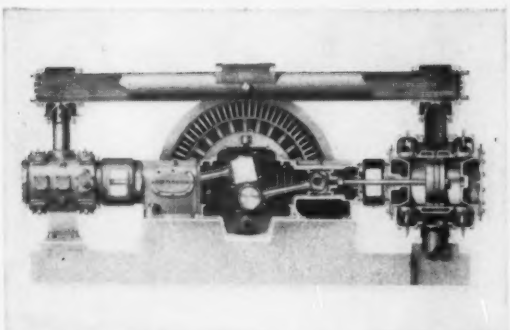
Industrial Gears and Speed Reducers
LimiTorque Valve Controls



LINEUP OF WORTHINGTON 2-cylinder gas compressors at Frontier Oil's new Tonawanda (N.Y.) refinery. Units are rated at 600 hp each.

Frontier's new refinery gets Worthington compressors



CUTAWAY VIEW of Worthington balanced-opposed compressor. Note low silhouette, modest foundation requirements, and double-throw crankshaft which permits as many as four pairs of cylinders to be arranged on single compressor frame.

At Frontier Oil Refining Company's big new refinery in Tonawanda, N.Y., two Worthington type BDC-2 balanced-opposed gas compressors have gone to work in the two stage compression of hydro-carbon gas mixtures. By selecting Worthington units, Frontier made sure of:

Smooth, vibrationless operation. Two throw crankshaft with cranks set at 180 degrees gives opposed piston action.

Low-cost installation. Packaged design provides quick and easy field assembly. Lack of vibration permits location on small foundation.

In chemical plants and general industrial installations, these Worthington units are paying off in dependable operation. You can use practically any type of drive to power them. Like all Worthington compressors, they are equipped with the exclusive Feather* Valve — lightest, tightest, most efficient valve made.

Remember, no matter what your capacity or pressure requirements may be, there's a compact Worthington steam- or motor-driven compressor to fill the bill. Write Worthington Corporation, Compressor Division, Section K.3.5, Buffalo, N.Y. K.3.5

** Reg. U.S. Pat. Off.*

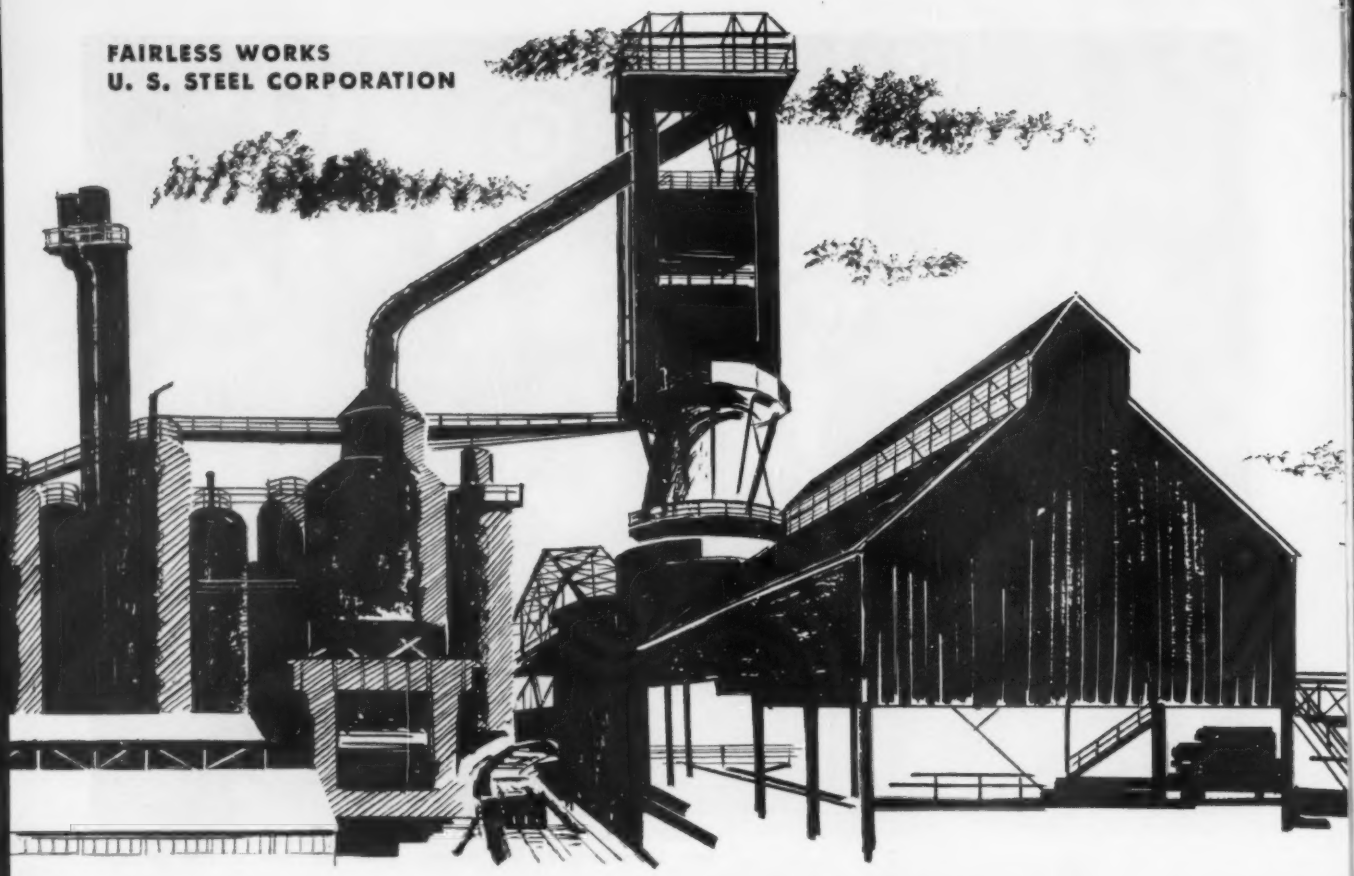
SEE the Worthington Corporation Exhibit in New York City. A lively, informative display of product developments for industry, business and the home. Park Avenue and 41st Street.

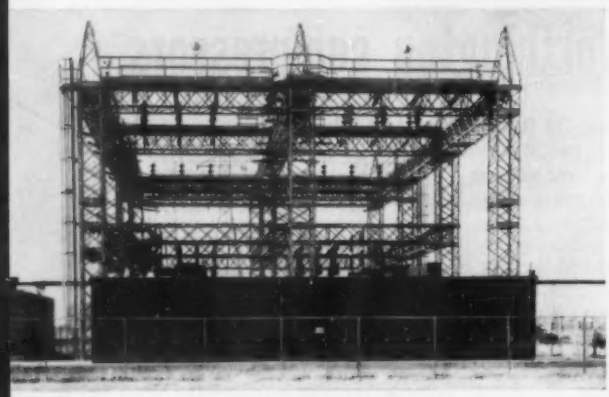
WORTHINGTON

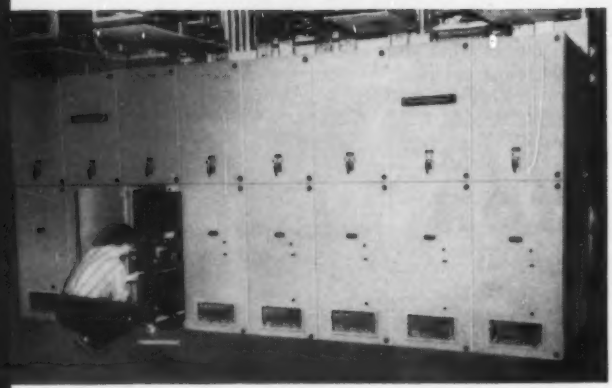
Only Worthington Compressors give you Feather Valve Performance

Y-Types **Balanced Angle** • **Balanced-Opposed** • **Direct Connected** • **Gas Engine**

FAIRLESS WORKS
U. S. STEEL CORPORATION







(*Top Left*) This substation is typical of the five servicing the mill, pump house, power house and power company incoming line areas.

(*Bottom Left*) D-C power distribution to the hot and cold mills, the open hearth, blast furnace, and coke plant areas is handled through Westinghouse low-voltage metal-enclosed switchgear.

(*Top Right*) Duplex control switchboards are used for local control, protection and metering of primary substations. Supervisory control relays are included to provide for normal unattended operation.

Matching modern power system design and apparatus to a new, completely integrated steel mill

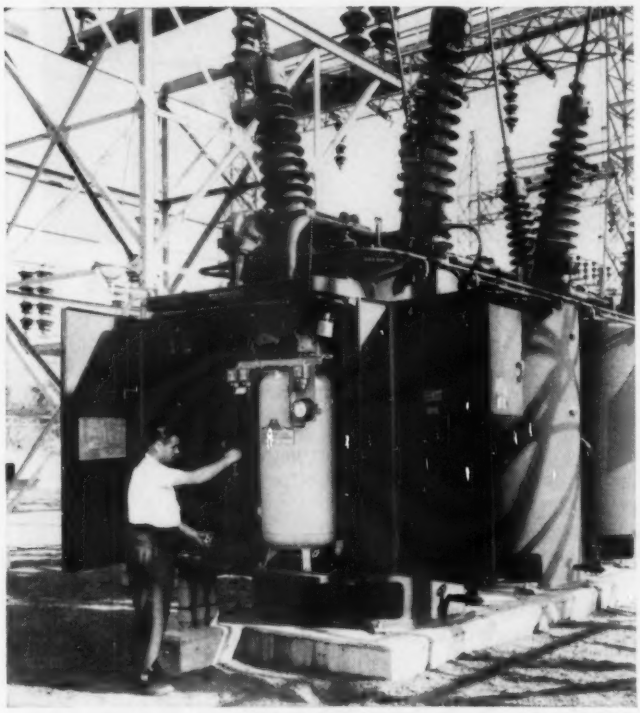
To the steel industry, Fairless Works was a "once-in-a-lifetime" opportunity: to apply—in one place—*every* technical advance in steelmaking.

The power system was no exception. With the valuable aid of Westinghouse application experience and AC Calculating Board studies, U. S. Steel engineers chose a 69-kv dual primary distribution system to all five Westinghouse-designed and manufactured substations. Secondary 13.8-kv distribution continues through Westinghouse metal-clad switchgear with Type DH, 500,000-kva air circuit breakers.

Then they matched this modern system with equally modern apparatus—much of it Westinghouse. Why Westinghouse? Because the advanced design and proved dependability of Westinghouse switchgear apparatus offered the best opportunity to provide maximum service continuity to Fairless Works—with minimum installation and maintenance expense.

Isn't there an idea here for you—if you're thinking about building a new plant or updating an old one? Just call your Westinghouse representative. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60872

YOU CAN BE SURE...IF IT'S Westinghouse

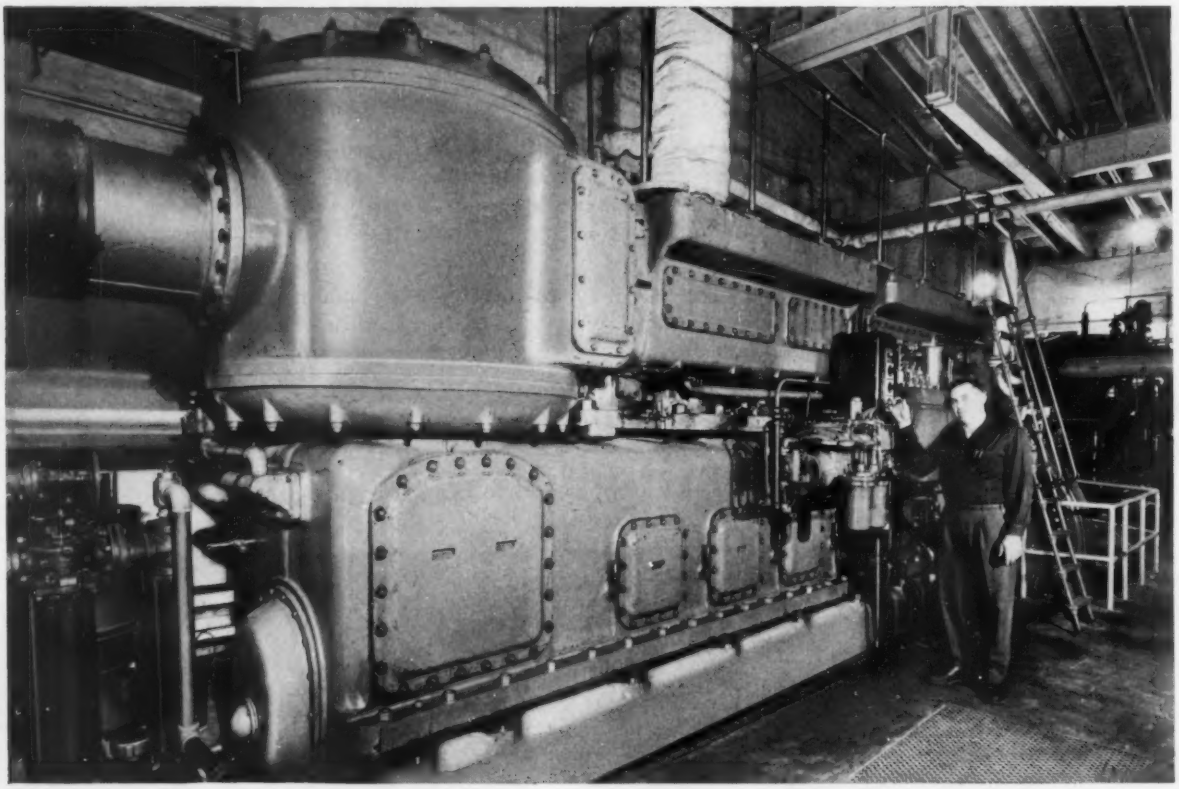


Three Westinghouse Type GM-5, 5000-mva circuit breakers are used for switching the 132-kv power company tie circuits. The 69-kv circuits employ fourteen Type GO-4B, 1500-mva circuit breakers.

This hot strip mill metal-clad assembly is typical of the indoor equipment used for the slabbing, blooming, billet and bar mills. A total of 200 Type DH, 500,000-kva metal-clad units are in service.

Westinghouse supervisory control concentrates operation of the distribution system for the entire works on a single desk. This centralized control provides for rapid and most efficient power distribution at all times.

"Our tests show Gascon® Oils best!"



. . . says A.E. Harms, CHIEF ENGINEER

YUKON MILL AND GRAIN COMPANY, YUKON, OKLAHOMA

It's *doubly* important that the Yukon Mill and Grain Company's 5 diesels operate with as little trouble as possible. For this plant not only supplies power for the mill, but also for the City of Yukon.

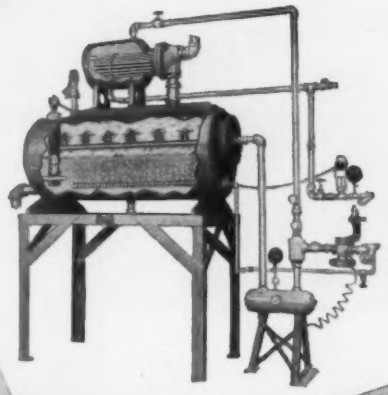
Chief Engineer Harms writes, "When we changed to Sinclair GASCON Oil D-HD, the results were extremely satisfying – wear has been greatly reduced, varnish is gone from pistons and cylinders and stuck rings are a thing of the past. As you might expect, we now use Sinclair exclusively."

You too, can rely on Sinclair's full line of top quality diesel lubricants. Phone your local Sinclair representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL LUBRICANTS
save wear and replacements

a Fresh approach . . . a Major advance . . .

in boiler feedwater deaeration



SCHAUB
ZERO-OXYGEN
Deaerators

NEW DESIGN! NEW PERFORMANCE! NEW SAVINGS!

Complete Oxygen Removal (to .005 cc/liter) • Complete Safety and Dependability • Wide Range for Load Variations • High Thermal Economy • Low Maintenance Costs • Simpler Design for Trouble-Free Service

Start with an idea that's *basically* new and better. Then produce performance beyond the best that ordinary deaerators can deliver. Schaub engineers achieved it . . . developed the all-new deaerator that's a major advance in boiler feedwater deaeration!

Two basic differences give the Schaub Zero-Oxygen Deaerator its outstanding advantages . . . note them well. First, it provides *external* pre-heating to a temperature *above* boiling point, with over-atmospheric pressure held only up to the internal sprayer manifold! Second, a free, non-restricted vent liberates *all* air *immediately* with maximum vapor heat recovery!

From these simple fundamentals stems a whole series of all-important performance benefits. Every engineer or operating man concerned with boiler feedwater deaeration should have the full facts on all-new Schaub Zero-Oxygen Deaerators. Simply send the coupon to get the complete story — promptly.

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FOR BULLETIN 575

Tells why you need deaeration. Explains basic differences in deaeration systems. Here's the complete story on new Schaub Zero-Oxygen Deaerators.

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Please send me without cost or obligation, my personal copy of your new bulletin 575 on Boiler Feedwater Deaeration.

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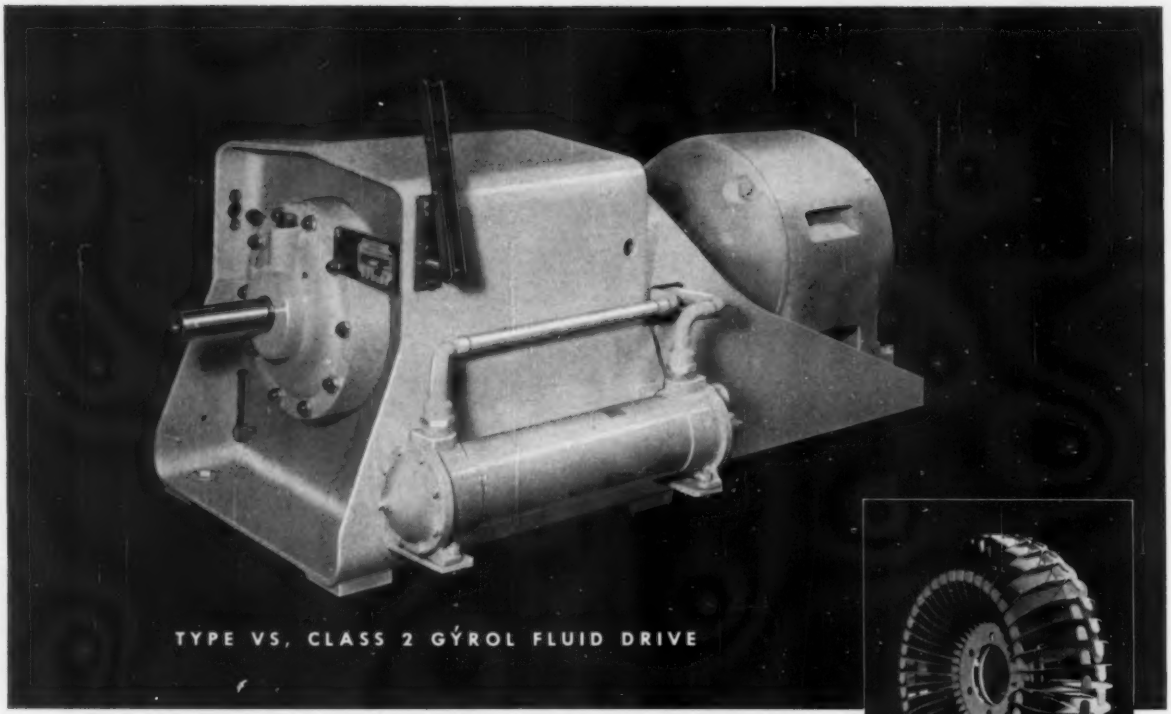

Phantom view of driving and driven members.→

New *Gýrol* Fluid Drive is reversible while in motion!

American Blower's new, class 2, adjustable-speed fluid drive offers unlimited application possibilities!

NEWEST member of the American Blower Gýrol Fluid Drive line, this versatile unit can be reversed while in motion—at any variable operating speed—by merely reversing the direction of rotation of the motor!

You'll find many other big advantages in this compact, self-contained unit for shockless, adjustable-speed control of fans, blowers, centrifugal pumps and compressors—and a wide variety of other industrial uses! Check the features of this new Gýrol Fluid Drive and see if it can be used in your own plant. It's a safe bet you will find several money-saving applications!

Get complete information about the American Blower Class 2, Adjustable-Speed Gýrol Fluid Drive from your nearest American Blower Branch Office. Or write us direct, Dept. 180-7, for your free copy of Bulletins 9419 and 9519. Do it, today!

FEATURES

- Can be reversed while in motion by reversing motor
- Speed range 5-1
- Across-the-line starting on many applications
- Motor can reach full speed before engaging load
- A compact, self-contained unit
- Trigger-action response—adjustable speed
- Speed may be controlled manually or automatically
- Six sizes, 7½ thru 800 hp—speeds up to 1800 rpm

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN • CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

YOUR BEST BUY AMERICAN BLOWER GÝROL FLUID DRIVES

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

Remember — the trade-marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS.

Why it pays to specify *The Leading Brand*

YOU SAVE three important ways when you specify TUBE-TURN Welding Fitting and Flanges. (1) You get the most advanced products available . . . assured by Tube Turns' pioneering research. (2) You get the exact fitting and flange for *your* problem promptly because Tube Turns has the world's most complete line . . . available nearby. (3) You get piping ideas through the outstanding Engineering Service and how-to-do-it information of Tube Turns.

These money-saving extras are yours when you specify "TUBE-TURN". Call your nearby Tube Turns' Distributor.

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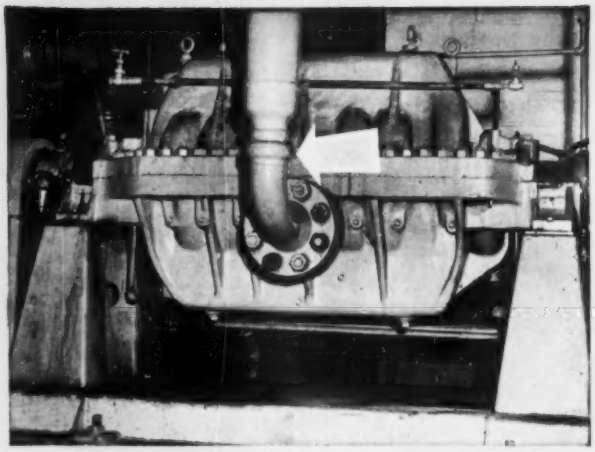
SEE HOW YOU SAVE

TUBE TURNS' *Engineering Service* helps save $50,000

A LARGE PROCESSOR had a problem of retubing seven large cooling units, formerly fabricated from copper tubing and fittings. Thin-walled aluminum was considered as a replacement; however, there were no satisfactory methods for fabricating the metal.

Tube Turns' Engineering Service Division, working with Alcoa, came up with the solution. Special TUBE-TURN Elbows and a new brazing technique were developed and the problem was solved. Total saving by customer was $50,000. This engineering service is one of the extras you get when you do business with the leader . . . Tube Turns.

THE JOB. Brazing **TUBE-TURN** Aluminum Returns to aluminum tubing for cooling coils.



NEW HYDRAULIC COUPLING. This unique new **TUBE-TURN** Coupling for hydraulic piping eliminates weld scale and protrusions at joints, protects pumps and other precision equipment for lowest-cost operation. You are sure to get the latest cost-saving developments in fittings and flanges when you specify "TUBE-TURN".

YOU GET COMPLETE SERVICE. Your nearby Tube Turns' Distributor gives you the exact answer to your specific piping problem from the world's most complete line of welding fittings and flanges. It includes more than 4000 items . . . in all piping materials, schedules and sizes. This service is backed up by Tube Turns' engineering assistance.

Information . . . Tube Turns has compiled data on many phases of piping application. This booklet, "Allowable Working Pressures" is yours for the asking. Just mail the coupon.

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Please send free copy of booklet, "Allowable Working Pressures".

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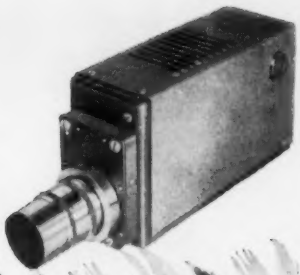
TUBE TURNS

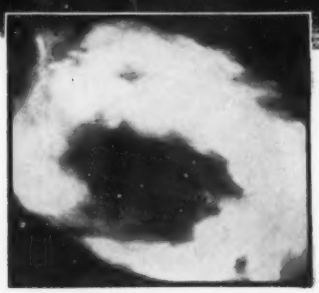
LOUISVILLE 1, KENTUCKY

A DIVISION OF NATIONAL CYLINDER GAS COMPANY

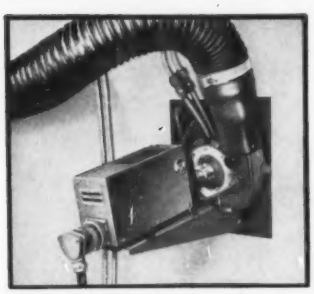
A New Tool For Boiler Operation



...with RCA Industrial TV



To observe tangential firing, water-cooled window can be installed at top of furnace . . . to observe direct firing, inside of furnace.



High-capacity blower and pump unit can serve two windows.

During light-off . . . to determine whether all burners are operating properly . . . changing fuels . . . or to check operation of burners . . . RCA Industrial TV with new water-cooled window, permits safe, convenient observation *at the control panel* 24 hours a day. Thus quick adjustment, above and beyond ordinary flame-failure safeguards, is a reality.

Observe smoke, combustion and ignition in furnaces, water level in boiler drums, or solve other difficult control problems the fail-safe way with high-detail RCA Industrial TV. Complete engineered package now available for power plants, plus installation and maintenance available through RCA Service Company. Years of television experience, hundreds of industrial applications, and RCA . . . the world's best name for quality, stand behind every installation of this equipment. RCA Service available throughout the country.

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Please send me information on RCA Industrial TV.

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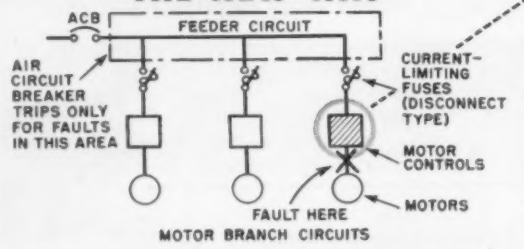
NOW... low-cost short-circuit protection for large, low-voltage motors with E-M

HI-FUSE LOW-VOLTAGE CONTROL!

● This simplified E-M Control, lower in cost than equivalent circuit breaker protection, brings to users of low-voltage motors an impressive series of advantages:

1. **HIGH INTERRUPTING CAPACITY** ... 100,000 rms ampere interrupting capacity, plenty for future expansion as well.
2. **CURRENT-LIMITING** ... disconnect type fuses minimize magnetic and thermal stresses on control components.
3. **FAST ACTING** ... faults are interrupted in ½ cycle or less; 100% availability with no adjustments needed.
4. **COORDINATED PROTECTION** ... includes fuse interruption on short circuits and overload relay trip on normal overloads.
5. **"BULL'S EYE" SELECTION** ... only the faulted circuit is interrupted. See diagram below.
6. **MINIMUM MAINTENANCE** ... there is nothing to wear out. Only occasional routine inspection required.

THE NEW WAY



When you have E-M Hi-Fuse, Low-Voltage Control on duty, you don't need to depend on a feeder circuit breaker, which would shut down all motors to clear a motor branch circuit fault. Instead, fuses in the E-M Control safeguard *each branch circuit*, clearing faults almost instantly while other motors continue in service.

One low-cost integrated unit!

E-M "pre-engineers" control components, arranging them together simply and effectively in one compact enclosure. You get complete, unified, dependable protection for motor and personnel at low cost! Ask your nearest E-M sales engineer for further information, and write the factory for Publication No. 218.

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Specialists in **PROTECTIVE CONTROLS FOR ELECTRIC MOTORS**

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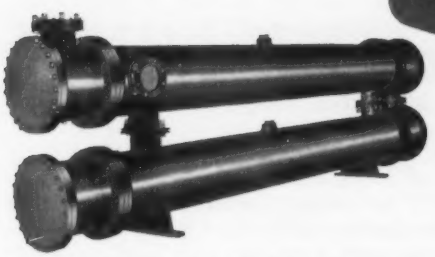
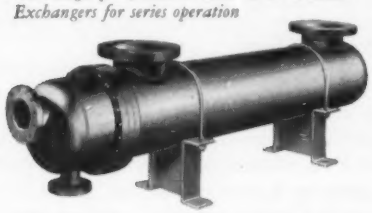
HEAT EXCHANGERS

Tank Suction Heaters • Oil Preheaters • Condensers • Evaporators • Aftercoolers • Gas Coolers Oil Coolers • Centrifugal Pumps Water Heaters



Two single pass, channel head B & G Heat Exchangers for series operation



B & G Heat Exchanger with U-bend tubing

B & G shell and tube Heat Exchangers give you *more value per dollar because they are built that way!*

Basically efficient in design, these units are offered with straight and U-bend tubing. Ample material thicknesses in every detail and high tensile strength bolting are assurance of lasting strength and long operating life. Full tube bundles and close tolerances between shell wall and baffles prevent slippage of fluid and assure maximum heat transfer. Units can be furnished with tubing of copper, steel, several of the stainless steels and other non-ferrous alloys.

B & G Heat Exchangers are built to ASME Code U-69 requirements and can be certified by Hartford Steam Boiler and Inspection Service.

Whatever your heat exchange problems may be, remember that the B & G engineering staff is always available for consultation.

For additional information on B & G Heat Exchangers send for Catalog DM-1150.

BELL & GOSSETT
COMPANY
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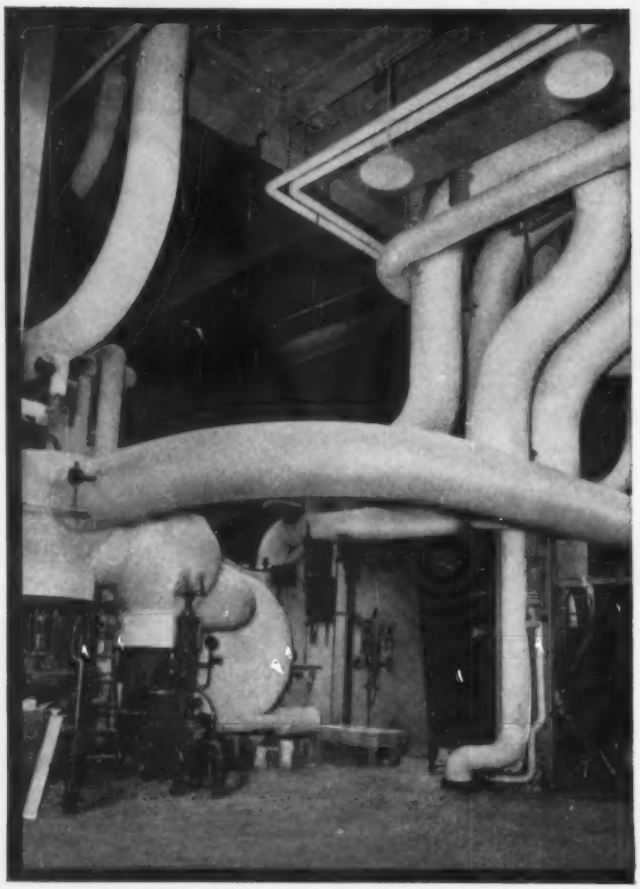
For safeguarding life and equipment Power Engineers prefer **NATIONAL SEAMLESS**



Today's power plant pressures of well over 1500 p.s.i., and temperatures of 1000°F. and more have necessitated material changes in power plant design. Of prime consideration, life and equipment must be safeguarded. Plant shutdowns due to premature tubing failure must be eliminated. And a system of pipe and tubes—free from potential areas of weakness—must be established. The one material invariably selected by designers to do the job is Seamless pipe and tubing.

USS NATIONAL Seamless Pipe and Tubes have never been surpassed for safe, efficient power plant service, even under the severest operating conditions. Pierced from solid billets of steel, NATIONAL Seamless Pipe and Tubes have all the strength, uniformity, and dependability of solid forgings. Each length is an homogeneous steel cylinder with uniform wall strength throughout, and is designed to remain structurally sound under high temperatures and tremendous pressures.

For further details on the use of NATIONAL Seamless in power installations, write for free Bulletins 10 and 26. Meantime, if you have the problem of planning a new installation, or repiping an old one, get in touch with us. Our engineers will be only too glad to give you the benefit of their experience.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS **NATIONAL Seamless PIPE AND TUBES**

WALLS WITHOUT WELDS

UNITED STATES STEEL

NEW "Small" boiler is a Big Quality package!

Available up to 150 hp — heating or processing — steam or hot water. A complete unit from a single source.

CLEAVER-BROOKS modern CB boiler

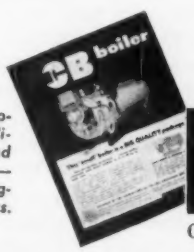
NO BOILER HAS EVER OFFERED SO MANY ADVANTAGES AND QUALITY FEATURES AT SUCH LOW INITIAL COST

• This NEW CB boiler has EVERYTHING needed to bring *big boiler standards* to commercial, industrial and institutional users with small capacity requirements. Despite its unusual, compact size you get big boiler performance — from matched-quality components, proved the world over on thousands of Cleaver-Brooks self-contained units.

Get all the facts NOW on how the new CB can help you save dollars. Make it a point to see . . . and *hear* the most silent-running, biggest boiler value available anywhere!

•

Call your nearest CB boiler representative (see your phone directory) or send for this illustrated catalog describing the NEW CB — designed by Cleaver-Brooks, originators of self-contained boilers.



gives you all the quality features of time-tested self-contained design

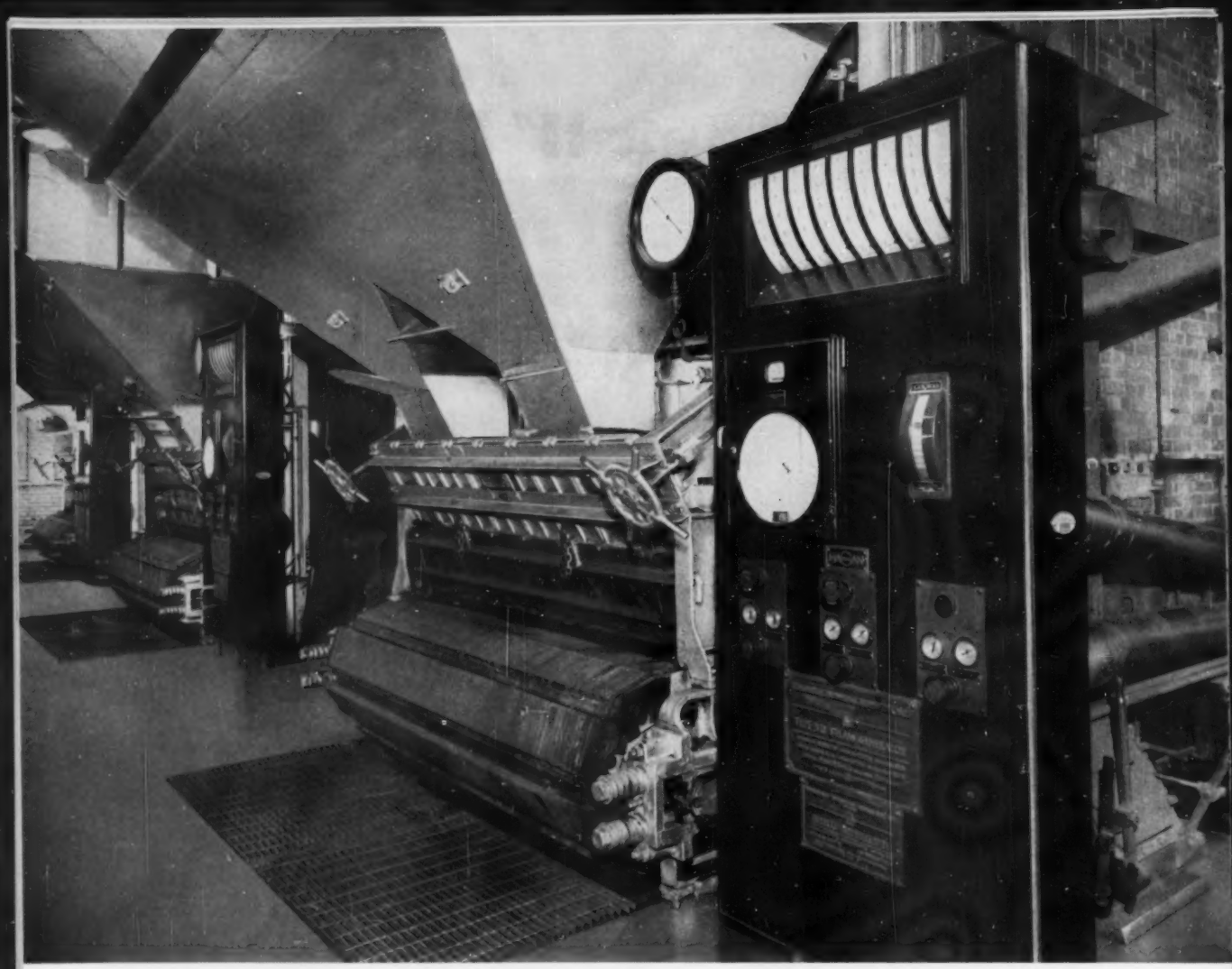
- **FOUR-PASS FIRETUBE CONSTRUCTION** — longer gas travel scrubs heat from flame — means lower fuel costs — guaranteed efficiency of 80% when firing with oil.
- **SILENT OPERATION** — even at peak load this boiler more than meets the low sound levels required for schools, hospitals, institutions.
- **FULL FIVE SQUARE FEET** — of heating surface per boiler hp — for longer service life and low maintenance.
- **FUEL FLEXIBILITY** — burns available light oil, gas, or combination oil/gas — simple, quick fuel changeover on oil/gas models.
- **FAST, EASY MAINTENANCE** — front and rear doors hinged for fast inspection, cleaning or servicing boiler.
- **AUTOMATIC SAFE OPERATION** — all controls centralized and conveniently located — modern electronic combustion control is standard equipment.
- **COOLER BOILER ROOM** — fiber glass blanket insulation and 16 gauge metal sectional lagging are non-corrosive, moisture and heat resistant.
- **FULLY APPROVED** — by Underwriter Laboratories; conforms to ASME codes; factory tested before shipment.

NOW—FIRST SIZES OF THE CB BOILER ARE MADE IN CANADA, TOO.

Cleaver Brooks

Cleaver-Brooks Company, Dept. P-300 E. Keefe Ave., Milwaukee 12, Wisconsin, U.S.A.
Cable Address: CLEBRO — Milwaukee — All Codes.

Originators of the Self-Contained Boiler



Pennsylvania R. R. saves $33,000 a year by burning coal the modern way

The Lafayette Street Power Plant of the Pennsylvania Railroad in Fort Wayne, Indiana, heats a passenger station, office buildings and repair shops. In addition, it also supplies steam for power, processing and car heating. To increase the efficiency of this coal-fired plant, the railroad replaced its old boilers with modern steam generating equipment, regulated by automatic combustion controls. At the same time, they modernized the ash removal system.

Today the cost of steam generation has been lowered from 77c to 59c per 1,000 pounds and combustion efficiency raised 25% higher than before. Overall heating costs have been cut $33,000 yearly.

Investigate Your Fuel Costs

If you're planning to modernize your plant or build a new one—or if you are just interested in cutting fuel costs—find out how coal, burned the modern way, compares to other fuels. Talk to a consulting engineer or your nearest coal distributor. Their advice may save you thousands of dollars every year.

facts you should know about coal

In most industrial areas, bituminous coal is the lowest-cost fuel available.

Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar.

Automatic coal and ash handling systems can cut your labor cost to a minimum.

Coal is the safest fuel to store and use. No dust or smoke problems when coal is burned with modern equipment.

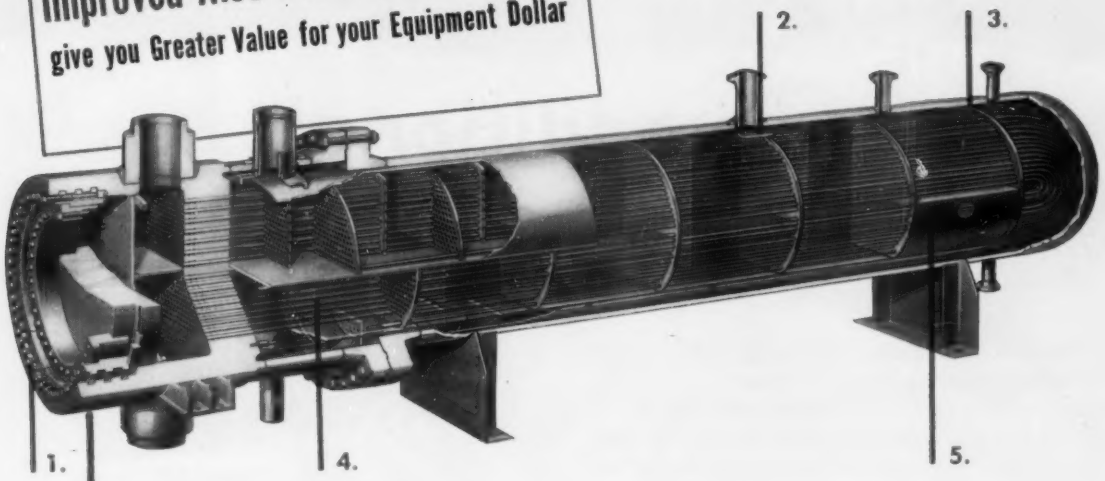
Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

BITUMINOUS COAL INSTITUTE
A department of National Coal Association
Southern Building, Washington 5, D.C.

Improved Alco Feedwater Heaters

give you Greater Value for your Equipment Dollar



Type "D" High-Pressure Closure: Simple, Economical, Corrosion-Protected

One of the latest developments in modern pressure-vessel design, the Type "D" high-pressure closure for Alco Feedwater Heaters gives you many important advantages. For example:

- Faster, easier maintenance—because all bolts and set screws are small (1¼" max. dia.) can be tightened with hand tools... and all parts except cover can be handled without heavy lifting mechanisms.
- Gaskets easily replaced without removing cover.
- Elimination of corrosion—because its unique design protects shear pieces and associated parts from contact with pressure fluids.

The Type "D" high-pressure closure is only one of the many special features offered you by Alco Feedwater Heaters.

Remember: Alco Feedwater Heaters—like Alco Flextube Evaporators—are designed and built to meet your own individual requirements—*and* the requirements of today's higher temperatures and pressures. Equally important, they're backed by more than 25 years' experience in serving power plants all over the country.

Your nearest Alco Products representative will be happy to give you the details . . . to show you in terms of your own operations how Alco Feedwater Heaters give you *greater value for your equipment dollar*.

Other special features of the New Alco Feedwater Heaters

1. **SMALLER SCREW FASTENINGS**

2. **IMPINGEMENT PLATES**—alloy steel, rigidly supported—for extra erosion protection, greater vibration resistance.

3. **SUPPORT PLATES**—drilled and reamed for close fit, chamfered to prevent cutting of tubes—for less vibration, longer tube life.

4. **LARGE ESCAPE AREA**—plus excellent steam distribution—for increased operating efficiency.

5. **CAREFULLY PLACED AIR-WITHDRAWAL BOXES**—to prevent air-binding.

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PRODUCTS

AMERICAN LOCOMOTIVE COMPANY
Sales and Service Offices in Principal Cities

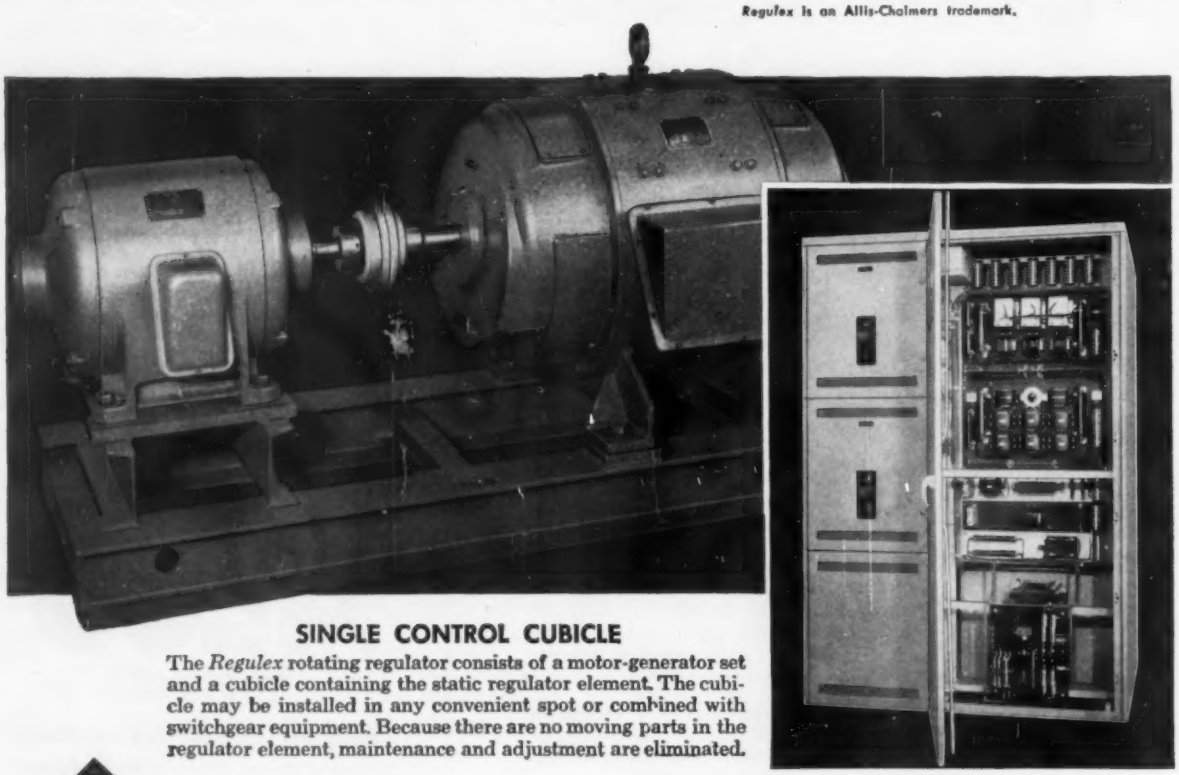
When power demands GROW

...gain additional Kilowatts with...

VOLTAGE REGULATORS

GENERATORS straining under the demand for ever-increasing kilowatt output take a new lease on life with the addition of *Regulex* voltage regulators. Automatic minimum excitation afforded by the *Regulex* voltage regulator allows the generator to operate close to the pull-out limit. Exceptional sensitivity and rapid response establish and maintain a safe ratio between generator load and field current. Operating limits at any given power factor are increased . . . best reactive kva division assured. It all adds up to maximum safe kilowatt output . . . more power to sell from your present generating equipment. For complete information call your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4369

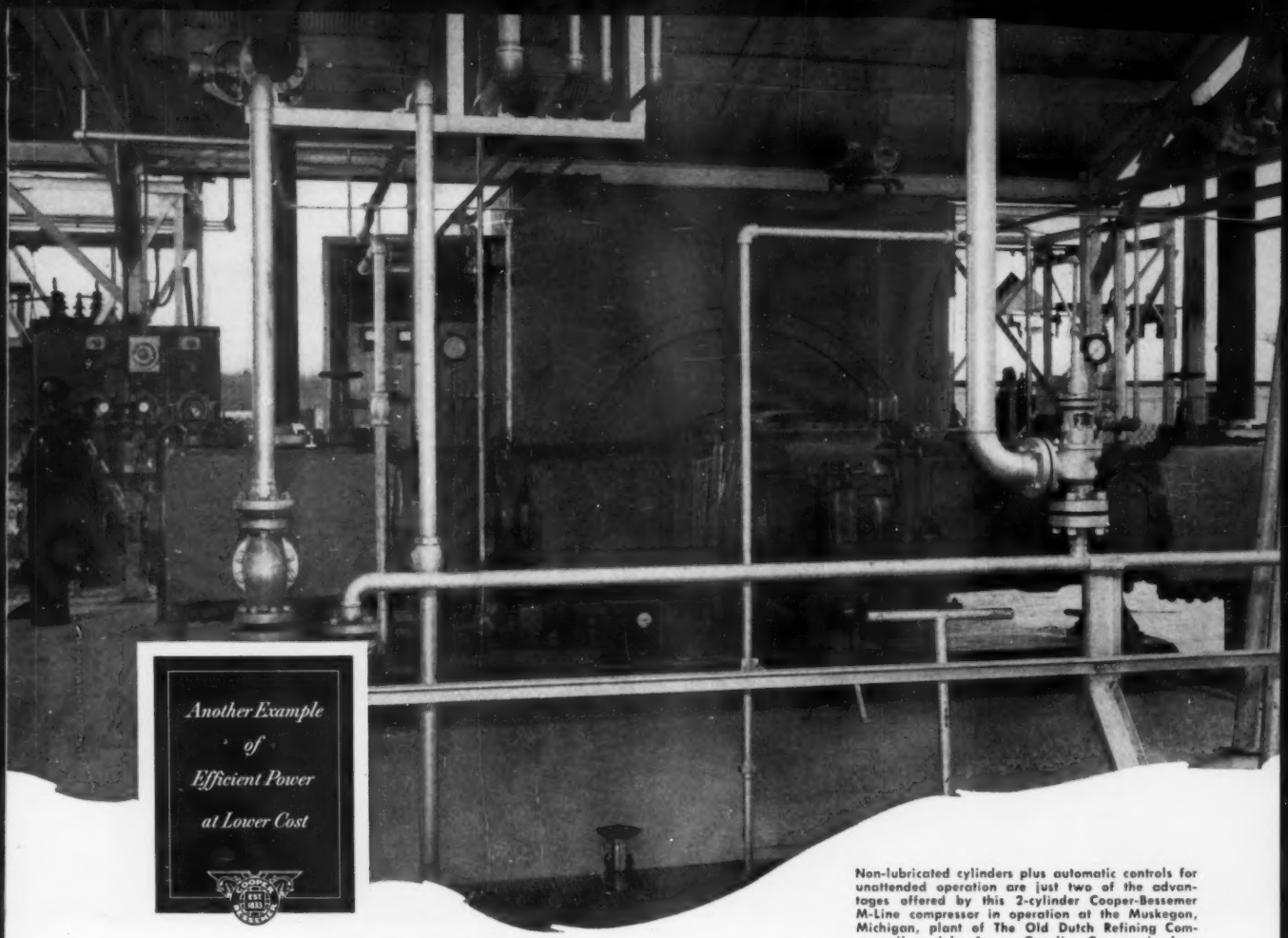
Regulex is an Allis-Chalmers trademark.



SINGLE CONTROL CUBICLE

The *Regulex* rotating regulator consists of a motor-generator set and a cubicle containing the static regulator element. The cubicle may be installed in any convenient spot or combined with switchgear equipment. Because there are no moving parts in the regulator element, maintenance and adjustment are eliminated.

A-C ALLIS-CHALMERS



Non-lubricated cylinders plus automatic controls for unattended operation are just two of the advantages offered by this 2-cylinder Cooper-Bessemer M-Line compressor in operation at the Muskegon, Michigan, plant of The Old Dutch Refining Company (leased by Aurora Gasoline Company) where the UOP Platforming process is in use.

"HYDROGEN COMPRESSES CLEAN"

... with Cooper-Bessemer's non-lubricated cylinders

RECYCLING millions of cubic feet of hydrogen a day for the UOP Platforming of low-octane gasoline, demands continuing efficiency from a smooth working compressor that will not contaminate the recycle hydrogen. That is one of the reasons why The Old Dutch Refining Company, leased by Aurora Gasoline Company, recently installed a 2-cyclinder Cooper-Bessemer FM compressor in their modern plant in Muskegon, Michigan.

To avoid contaminating hydrogen with oil in the recycle gas, Cooper-Bessemer successfully developed a non-lubricated compressor cylinder.

Operating against micro-smooth hardened cylinder liners, these 8" diameter carbon pistons require no lubrication whatever. With a mirror finish, the cylinder bores reveal no excessive wear.

No matter how exacting or complex your compressor problems, check the advantages offered by Cooper-Bessemer M-Line compressors. For dependability and money-saving operation, you can rely on Cooper-Bessemer — one of America's oldest engine builders offering the latest in engineering advancements.

MOUNT VERNON, OHIO

COOPER-BESSEMER

GROVE CITY, PENNA.

New York City • Seattle, Wash. • Bradford, Pa. • Chicago, Ill. Houston, Dallas, Greggton, Pampa and Odessa, Texas Washington, D. C. • Shreveport, La. • San Francisco, Los Angeles, Calif. • St. Louis, Mo. • Gloucester, Mass. • New Orleans, La. • Tulsa, Okla. • Cooper-Bessemer of Canada Ltd., Edmonton, Alberta—Halifax, Nova Scotia.

DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS

Utility company in Texas successfully combats corrosion with U. S. Uscolite Pipe in 6 of its plants

All 6 plants use chlorine to control slime growth in "cooling water." One of the 6 plants (shown below, in Corpus Christi, Texas) also uses chlorine to control marine growth in sea water used exclusively for cooling. In addition, this plant uses Uscolite pipe to combat another enemy—high salt content of soil which corrodes metal pipe from outside and causes failure. These are the reasons why the utility company changed from iron pipe (which lasted only 4 years) to Uscolite® pipe, which is expected to last 30 years. Unlike other piping, Uscolite is not attacked by chlorine or most chemicals, or even sea water.

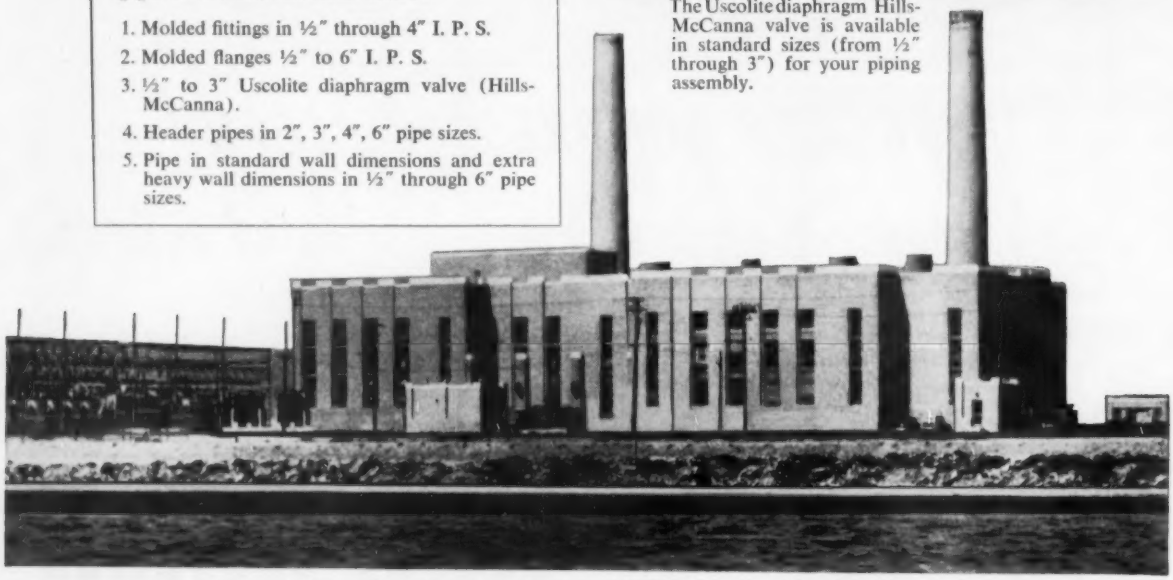
Uscolite is manufactured exclusively by United States Rubber Company. It has extremely high impact strength, high endurance, needs absolutely no maintenance, is very lightweight. It is available in standard lengths, and can be cut to length and threaded on the job.

Uscolite is the answer to corrosion and maintenance problems in piping. Any of the 27 "U. S." District Sales Offices will provide complete assistance and facts. Or write to address below.

Uscolite pipe and fittings come in the broadest and largest line of stock sizes of plastic pipe on the market. Sizes follow:

1. Molded fittings in ½" through 4" I. P. S.
2. Molded flanges ½" to 6" I. P. S.
3. ½" to 3" Uscolite diaphragm valve (Hills-McCanna).
4. Header pipes in 2", 3", 4", 6" pipe sizes.
5. Pipe in standard wall dimensions and extra heavy wall dimensions in ½" through 6" pipe sizes.

The Uscolite diaphragm Hills-McCanna valve is available in standard sizes (from ½" through 3") for your piping assembly.



*Above is photo of one of the plants, owned by Central Power & Light Co., Texas

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# of operation without one minute of trouble!

■ During six continuous years of start-and-stop operation, the diesel in the Village of Fairfax, Minn., power plant has produced almost five million KW hours of power. Not once in this period has the engine been down for overhaul . . . pistons, cylinders and rings have remained deposit-free and clean.

This extraordinary record of trouble-free operation is traceable to two important maintenance factors: *1.* the job-proved superiority of STANDARD HD Oil . . . an oil specially designed to prevent wear of vital diesel parts and to provide clean operation; and *2.* regular check by a Standard Oil lubricating specialist of all operating data and a periodic analysis of oil samples—all to make sure engines are always operating in top form.

In the photograph above Fairfax Plant Superintendent Frank Chesire (left) goes over operating data with Standard lubrication specialist, A. F. Moldenhauer (right) on one of his regular periodic visits. You too, can put this kind of service to work for you. Call your nearest Standard office. Or write to Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY

STANDARD (Indiana)

24 ACRES *Cover the World*

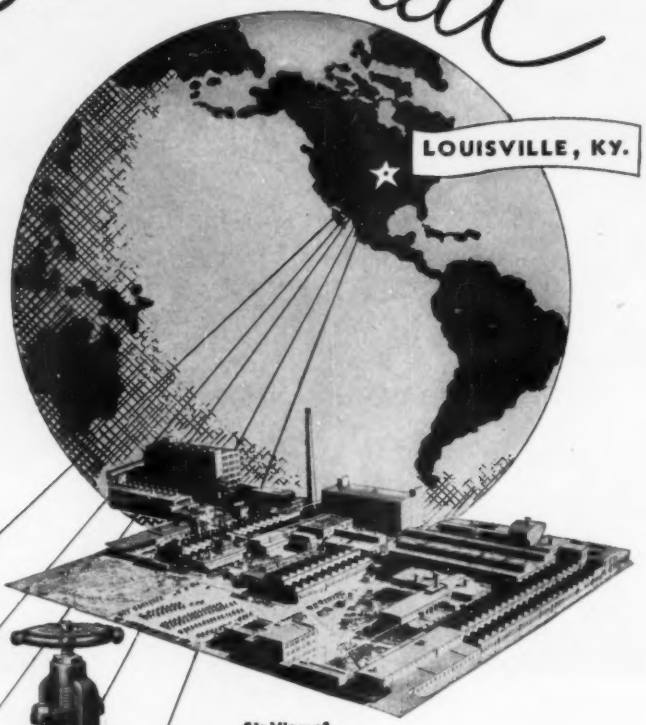
. . . with TOP QUALITY

DROP FORGED STEEL

VALVES, FITTINGS and FLANGES

by

Vogt



Air View of
Henry Vogt Machine Co.

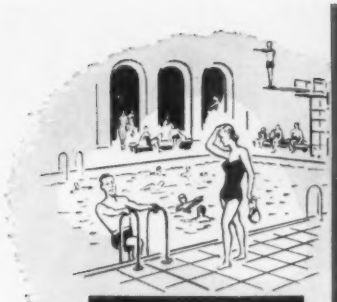
This 24 acre Vogt plant supplies the most comprehensive line of top quality *drop forged* steel piping materials anywhere available to industry. That's why they're the choice of leading refineries, power plants, chemical plants, etc., the world around!

OUR COMPLETE LINE INCLUDES

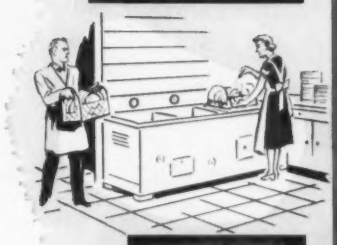
Flanged, Screwed and Socket Weld End Globe, Gate and Check Valves • Ells, Tees and Crosses • Couplings • Bushings • Plugs • Unions • Flanges and Flange Unions • Welding Heads

HENRY VOGT MACHINE CO. LOUISVILLE 10, KY.

Branch Offices: New York, Philadelphia, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va.



SWIMMING POOLS



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SHOWERS

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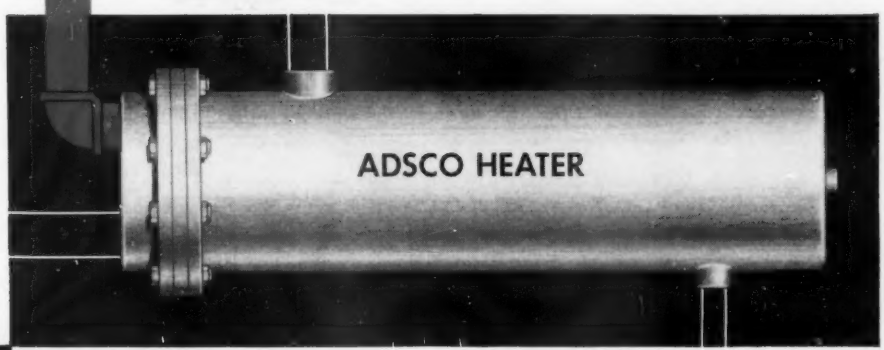
Hot water! Plenty of hot water! When and where you want it... and at low cost! ADSCO Water Heaters are dependable sources of hot water in any type of plant or building wherever there is a steam supply. Use ADSCO Water Heaters for space heating, for process hot water, or for such general service as showers, laundries, dishwashers, swimming pools...even for snow melting. Write today for Bulletin 35-77 on Convertors, or Bulletin 35-78 on Instantaneous Heaters.

Where storage heaters are needed, write for ADSCO Bulletin 35-75.



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AMERICAN DISTRICT STEAM COMPANY, INC.

GENERAL OFFICES
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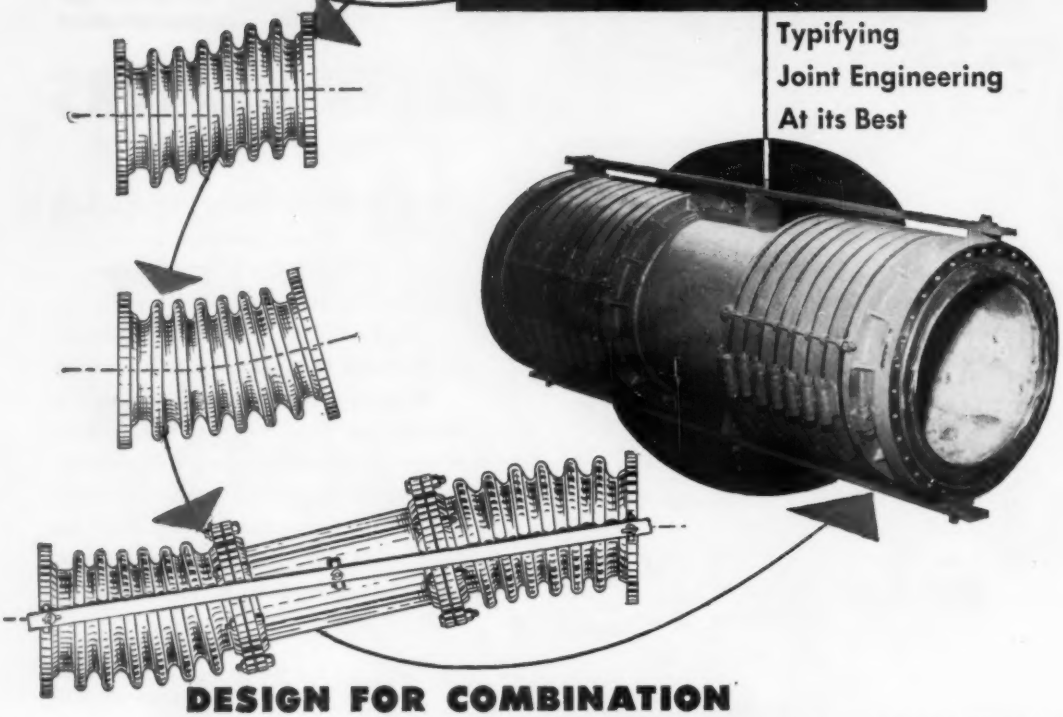

DESIGN FOR COMBINATION LINEAR-SHEAR-LATERAL MOVEMENTS

Study these sketches showing (somewhat exaggerated, of course) several of the more complex movements to which expansion joints are often subjected. Do you have such pipe line conditions? Do you have any installation coming up that might involve such movements?

Here's the Badger Joint that is designed for just such a problem: the TANDEM JOINT. It's available in both Self-Equalizing and Non-Equalizing design. The joint movement is controlled by the tandem bars pivoting on a pin in the connecting nipple. Permissible shear or lateral movement depends upon the overall length as well as the number of corrugations in each unit. Each tandem unit is designed to suit the individual job requirements.

The Tandem Joint is but one of several special types designed for complex pipe line movements. We'll be glad to study your problem and make recommendations. Should yours be a straight linear traverse—as most installations are—we have a wide range in Directed Flexing, Self-Equalizing and Non-Equalizing Joints made of copper or stainless steel, with flanged or welding ends.

Badger Expansion Joints come in a variety of types and a wide range of sizes: Directed Flexing, Self-Equalizing for longer traverses and higher pressure; Non-Equalizing, for shorter traverse or when pressures are low. Tandem Joints for combination axial and lateral movements; Clevis Joints for angular rotation.

Special Vibration Control Joints; Flexible Pipe Line Seals for watertight connection between pipe and flood walls.

BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

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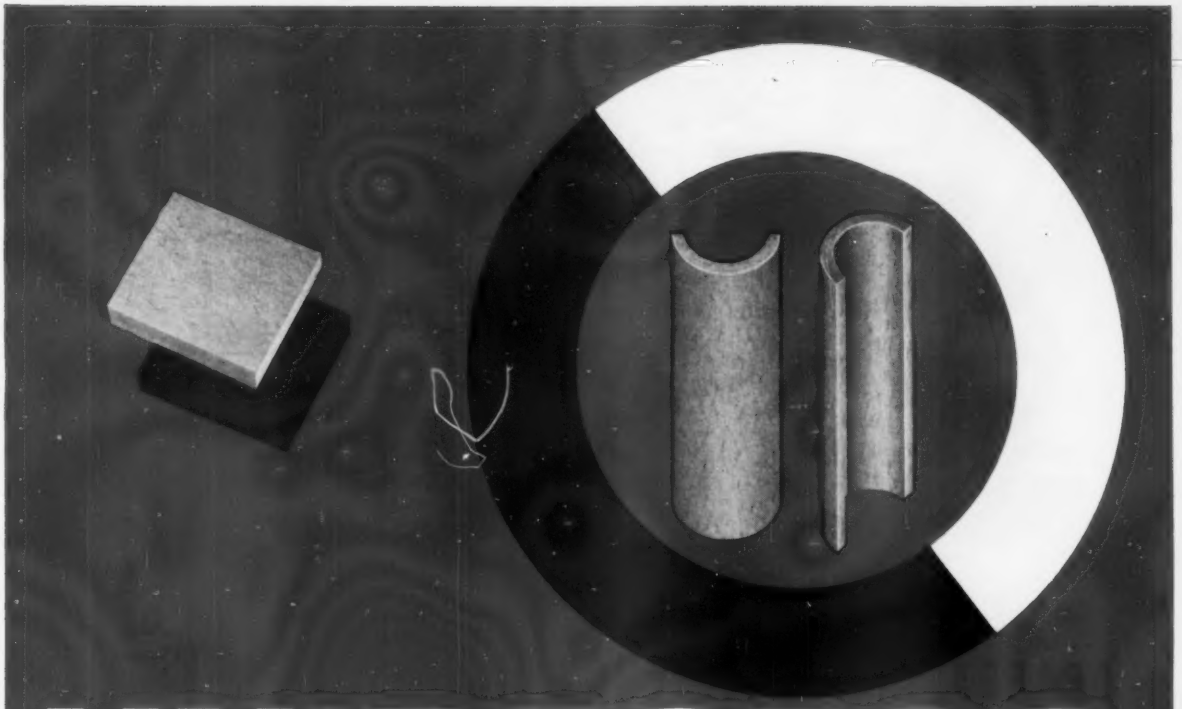

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- Tough. Will not crack, crumble or powder
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- Reusable - Low maintenance cost
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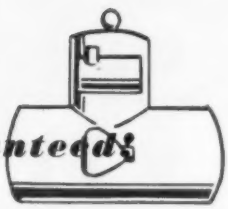
less than seven parts per billion guaranteed!



These are words. What you want is *PERFORMANCE.* Cochrane's unparalleled experience in years and number of installations with all types of deaerating equipment assures you that *guarantees will be met!* Check this statement with any Cochrane user.

Cochrane has the greatest number of deaerating heater installations of any manufacturer in the world. Manufacturing every type of deaerating heater and water conditioning equipment, Cochrane's *complete* service assures you unbiased recommendations for equipment to performance specifications. It assures undivided responsibility for engineering, fabrication and satisfactory continuing operation by a single company.

For further information on Cochrane Deaerators, write for Publication Nos. 3005, 4643 and 4635.

Other Cochrane Processes

DEMINERALIZER

Cochrane ion exchange units deliver a continuous supply of demineralized silica-free water at extremely low cost. Pub. No. 5800.

HOT ZEOLITE

Replaces second stage phosphate treatment in hot-process softener. High temperature ion exchange resins completely remove residual hardness at great savings in soda ash and phosphate. Pub. No. 4801.

SOLIDS CONTACT REACTOR

Slurry blanket principle efficiently removes solids, turbidity, color, taste, silica, fluorides, and reduces alkalinity from water for industrial and municipal purposes. Pub. No. 5001-A.

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Canadian future

A FEW WEEKS AGO, I stopped off in Windsor, Ontario, for the 15th annual meeting of the Institute of Power Engineers. It was my first opportunity to sit in session with this group. I brought back some strong impressions of this growing Canadian engineering organization, of the men who compose it, and the part they will play in the great industrial future that lies ahead for their country. So strong were these impressions, in fact, that I compared notes extensively with POWER editors who have traveled widely in Canada.

Some impressions, of course, need no analysis—the warm welcome from long-time readers of POWER, the quick friendliness of new engineer acquaintances, the gracious hospitality of members and officers of IPE. In their special way, these are part of the common experience of all who visit our neighbors to the north.

Of other impressions, the most important, it seems to me, is the attitude Canadian power engineers take to their profession. I use the word "profession" advisedly, because the attitude is a highly professional one. Whether it is the result of strong license laws, or the fact that many of these men started their careers in the strict school of the British merchant service, or just of the national climate, I can't say. The key fact remains—the many Canadian power engineers I met seemed proud of their work, serious in their pursuit of it, fully aware of its responsibilities.

This, I think, explains a good deal about the character and strength of IPE. Drawing its members from an engineering fraternity of high standards, it has been blessed with wise and energetic leaders. With engineering activity widely scattered outside the metropolitan centers, IPE has offered a needed unifying influence. Accordingly, it has grown rapidly, in total membership and in number of branches.

But growth is only one index of influence. Not satisfied with pious gestures toward an educational program, IPE has broken new ground, come up with some solid achievements, has more on the way. And it works constructively on the legal front.

Canada is now enjoying an industrial boom based in large measure on its vast resources. It is a truism that no social or economic advance can be made without power, but in Canada this assumes added significance because much of the growth is in power-hungry industries. And Canada has the potential.

Not least among Canada's resources is the Institute of Power Engineers and the men it represents. Like power men everywhere, they have a special place in the drive toward higher living standards. We on POWER are proud to share this responsibility.

Proven On loads *UNDER* 600 Amps . . . .

Fusetron dual-element Fuses Have an Interrupting Rating in Excess of 100,000 Amps.

An interrupting rating in excess of 100,000 amperes for FUSETRON dual-element fuses . . . this was shown by tests that were conducted under conditions that simulated the most severe field conditions. These tests were witnessed and verified by the Electrical Testing Laboratories of New York.

The test circuits were set to deliver far in excess of 100,000 amperes — yet the 250 and 600 volt FUSETRON fuses cleared the shorts without igniting readily flamable material placed around the fuses . . . and there was comparatively little noise.

These tests show that Fusetron fuses, even in the small 30 ampere range, can interrupt safely the most severe available short circuit current.

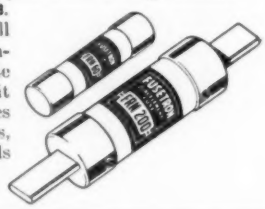
No interference with time-lag

Time-lag is of utmost importance to give proper motor and electrical protection and to eliminate needless blowing of fuses. Even though the interrupting capacity has been greatly increased, the time-current characteristic of Fusetron fuses has in no way been disturbed.

ALL THIS ADDED SAFETY

without changing a panelboard or switch . . . plus 10 point Protection of FUSETRON dual-element FUSES!

1. Protect against short-circuits. **2.** Protect against needless blows caused by harmless overloads. **3.** Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation. **4.** Provide thermal protection — for panels and switches against damage from heating due to poor contact. **5.** Protect motors against burnout from overloading. **6.** Protect motors against burnout due to single phasing. **7.** Give double burnout protection to large motors — without extra cost. **8.** Make protection of small motors simple and inexpensive. **9.** Protect against waste of space and money — permit use of proper size switches and panels. **10.** Protect coils, transformers and solenoids against burnout.



Fusetron Fuses Help eliminate needless Shutdowns for Production Engineers.

Work stoppages caused by needless blows are prevented. Even if all the motors on a circuit start at one time or other harmless overloads occur, the fuse link holds to prevent a shutdown.

Likewise, Fusetron fuses guard against needless blows caused by excessive-heating in panelboards and switches—lesser resistance results in cooler operation.

Fusetron Fuses Offer Maximum Safety for Electrical and Safety Engineers.

With an interrupting rating of 100,000 amperes, Fusetron fuses give the greatest possible protection against damage due to short-circuits. And just as important, they reduce the hazard of motor burnouts due to single phasing and overloading.

Fusetron Fuses Save Time and Work for Maintenance Engineers.

Once properly installed, Fusetron fuses require no costly inspection time or down-time for calibration and other maintenance necessary on mechanically operated devices.

Unnecessary repair work on motors is avoided because Fusetron fuses reduce to a minimum the danger of damage due to electrical faults. If trouble occurs, instead of rewinding or replacing burned out motors, simply replace Fusetron fuses.

Switches and panelboards are protected against damage from poor contact heating.

Fusetron fuses also protect against needless blows that cause irritating interruptions of regular maintenance.

Proven On loads *ABOVE* 600 and up to 5,000 Amps.

BUSS Hi-Cap Fuses Have an Interrupting Rating In Excess of 100,000 Amps. . . . *and their blowing time can be coordinated with that of Fusetron fuses.*

An unlimited interrupting rating for BUSS Hi-Cap fuses on any voltage up to 600 . . . this was confirmed by tests reported by the Electrical Testing Laboratories of New York.

BUSS Hi-Cap fuses are designed to give protection against dangerous overloads as well as high fault currents — yet retain the speed of operation necessary to limit heavy short currents to safe values.

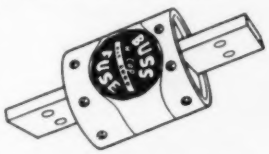
When coordinated properly with Fusetron dual-element fuses they will not open ahead of the fuse nearest to the fault — thus the trouble is isolated to the part of the circuit in which the fault occurs.

Added SAFETY on Old Installations

On installations where the increase in the capacity of the circuit has outgrown the interrupting rating of the circuit breakers, BUSS Hi-Cap fuses offer a safe and relatively inexpensive way to protect inadequate breakers against rupture in event of bad fault.

ACTION THAT SAVES YOU MONEY

Don't risk losses. Delay may cost you far more than replacing every fuse with a FUSETRON fuse. By passing the word along that all purchase and stock records should call for FUSETRON dual-element fuses on loads up to 600 amperes — and BUSS Hi-Cap fuses on loads above that, you get action that begets money saving.



On New Construction tell your architect to specify this Safer, Better Protection.

Fusetron Fuses Cuts Cost for Top Management.

Cuts maintenance cost — Fusetron fuses are maintenance free.

Cuts motor repair cost — Fusetron fuses guard the motor, against damage due to overloading, single phasing, short circuits and other electrical faults.

Cuts production costs — Shutdowns due to needless blows are eliminated.

Cuts new installation costs — Smaller sizes can be used, therefore big savings can be made on switches and panelboards.

Cuts present installation costs — Fusetron fuses hold and won't open on starting currents so the need for larger panelboards and switches is often eliminated — and in many cases new motors can be added to the circuit without installing larger panelboards or switches.

Play Safe—Install Fusetron Fuses and BUSS Hi-Cap Fuses now!

For blowing time charts or more information on FUSETRON fuses and BUSS Hi-Cap fuses use coupon or write for bulletin FIS and HCS.

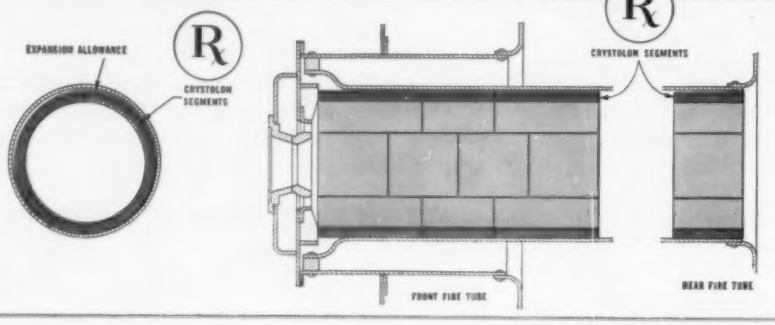
FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

BUSSMANN Mfg. Co.
(Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.
Please send me complete facts about FUSETRON dual-element Fuses and BUSS Hi-Cap Fuses.

*Name*_____
*Title*_____
*Company*_____
*Address*_____
*City & Zone*_____ *State*_____ 954

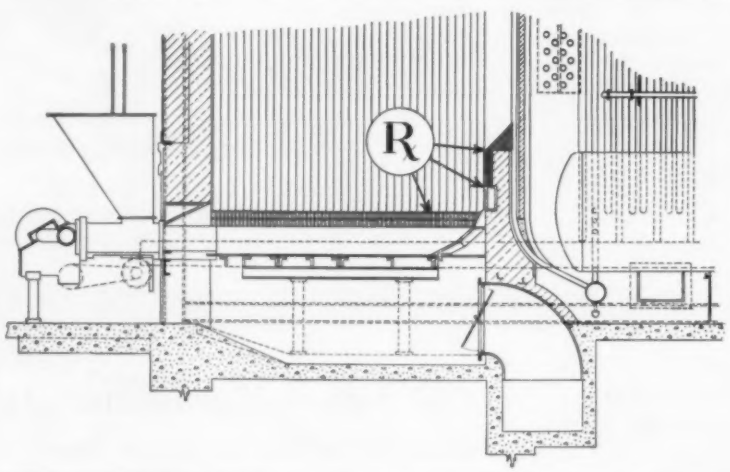
Rx for more efficient, lower cost operation of packaged boilers

Norton CRYSTOLON* refractories are engineered for maximum boiler protection and prescribed for toughest service conditions



Fire Tube Packaged Boilers

CRYSTOLON segmental linings support combustion in the fire tube and protect the metal jacket. Use tongue-and-grooved segments for smaller sized boilers, arch brick for larger boilers.



Water Wall Packaged Boilers

CRYSTOLON armor block at the grate level overcomes the severe abrasive action of fuels and clinker formations. Brick and air setting cement of this same highly refractory material give added protection to the bridge wall.

Norton CRYSTOLON refractories, *engineered and prescribed* for better boiler performance, are characterized by exceptional hot strength, high refractoriness and thermal conductivity and great resistance to slag penetration, spalling and abrasion. Providing maximum protection against the mechanical and chemical attacks of a wide variety of fuels, they eliminate many costly repairs to grates and settings, as well as reducing downtime and maintenance costs to new lows.

Get this new booklet

describing how Norton refractories supply money-saving B's for your boiler application. Write for your copy of *Refractories for Heat and Power* to NORTON COMPANY, 451 New Bond Street, Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Company, Ltd., Toronto 5, Ontario.

NORTON

REFRACTORIES

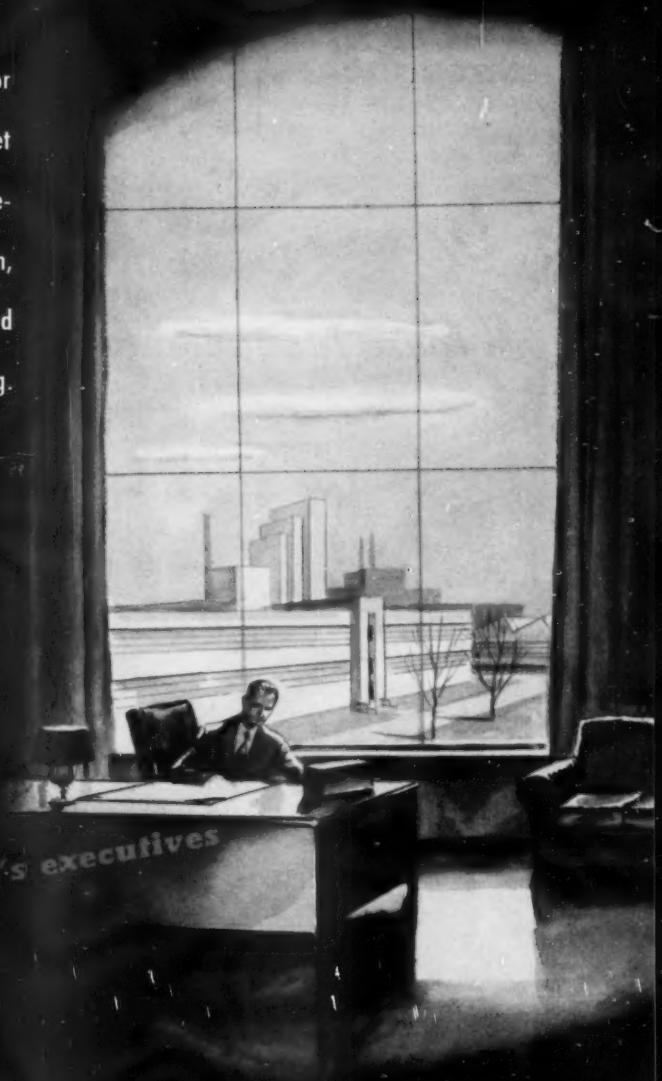
Engineered... Rx... Prescribed

Making better products... to make other products better

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

NEW PROFIT OPPORTUNITIES IN THE POWER SERVICES

. . . showing how a typical manufacturing or service organization can add 10% to net income before taxes by topnotch management of the power services – water, steam, mechanical power, electricity, compressed air, refrigeration and air conditioning.



An engineers' report to America's executives

Power DECEMBER 1954

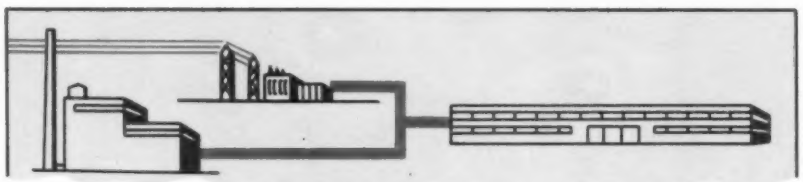
Sound power-service management . . .

MANUFACTURING	EXTRACTIVE	SERVICE
metalworking	mining	hotels
textile	quarrying	stores
automotive	lumbering	hospitals
chemical	petroleum	laundries
steel	mining	institutions

throughout American industry . . .

water	mechanical power	refrigeration
steam	compressed air	air conditioning
electricity		

in these fundamental services . . .



their generation, distribution and application . . .

THIS report from the editors of POWER to the top management of America's industries and institutions reveals neglected opportunities for profit.

In round figures, we estimate that executive attention to these opportunities could raise net income before taxes by 10% on the average.

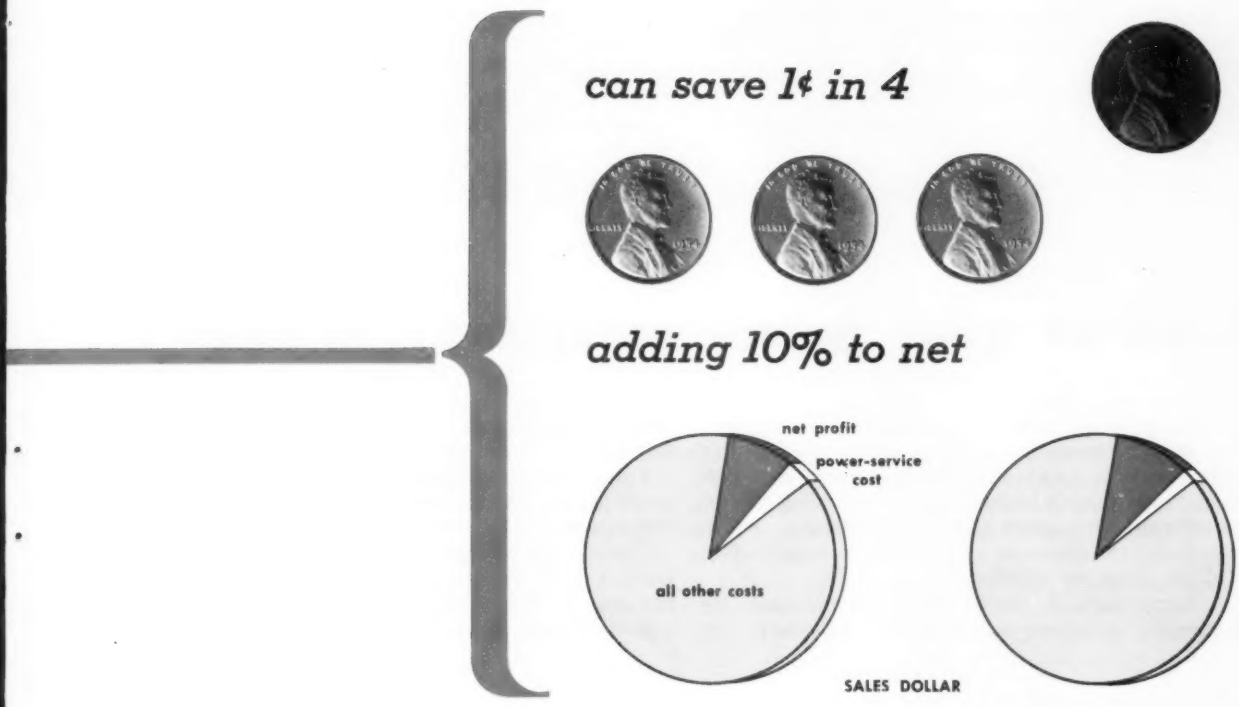
These untapped profits lie in the broad area of the power services—water, steam, mechanical power, electricity, compressed air, refrigeration and air conditioning—their procurement and application.

Experience shows that, in this area, informed management can save one cent in four—again an average figure. If net before taxes is 10 cents of the sales dollar, and if aggregate power-service costs are four cents, this represents a 10% gain in net.

Another way to put it is: $100,000 earned in the power services is worth a million in added income.

In general, the full potential can be realized only where the engineers in charge of the power-service operations have the cooperation and guidance of an informed top management.

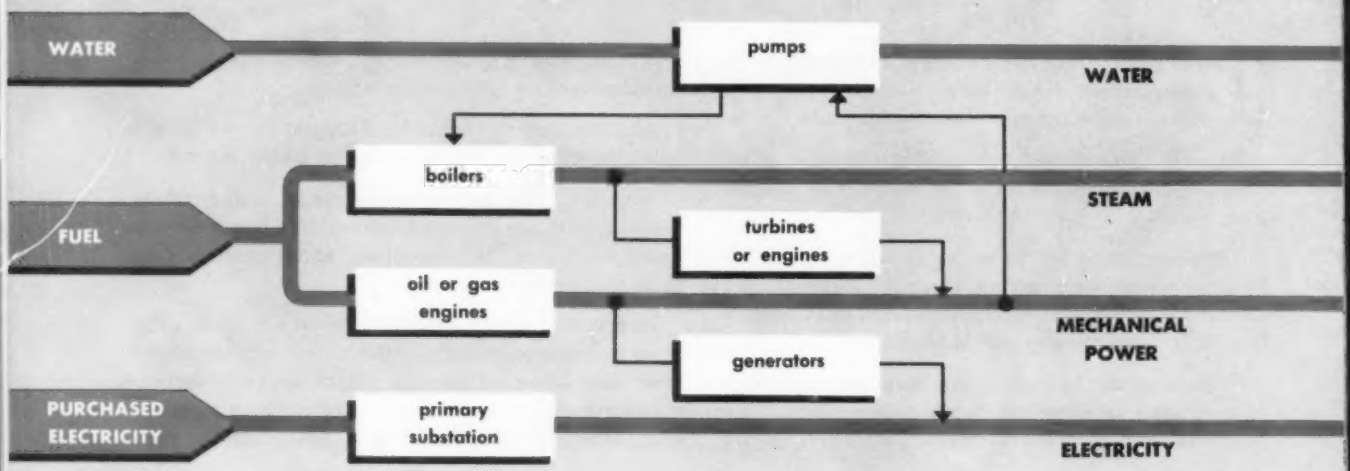
Hence this report—designed for quick reading by busy executives. It outlines the power services, shows how they serve production, points up profit opportunities, indicates the essentials of a sound relationship between management and power-service men.



Energy (in fuel and often in bought electricity) and *water* are raw materials for . . .

energy conversions: Fuel and water make *steam*. *Mechanical power* comes from turbines, engines. With it, pumps produce *water service*. Generators convert mechanical power to *electricity*. This gives . . .

4 primary services. These are *water*, *steam*, *mechanical power* and *electricity*. Note that . . .



MASTER CHART OF THE POWER SERVICES

The power-service job is essentially one of converting energy from any one form into another more suitable for distribution or use. Take, for example, the sequence above that starts with raw energy in fuel. This may be converted directly into mechanical power, or may make steam. The steam may serve for heating, or make mechanical power.

We want mechanical power to generate other services—pumped water, compressed air, refrigeration, air conditioning—and to drive production machines. But we find electricity more convenient for distribution, so we make it from mechanical power, or buy it from a utility. Then, out at the job, motors convert electricity back into mechanical power.

Look at your power services . . . it pays

To you, as an executive, the parts of your organization directly concerned with its product or service naturally loom large. But the operations that give America the world's highest standard of living depend on services often taken for granted—shelter, power, heat, light, maintenance, lubrication, to name a few. Without these, nc wheel can turn.

A hard look at these essentials will pay, for in them lie unrealized profits. Such a look reveals two broad groups: what might be called the *protection* services, and the *energy* services.

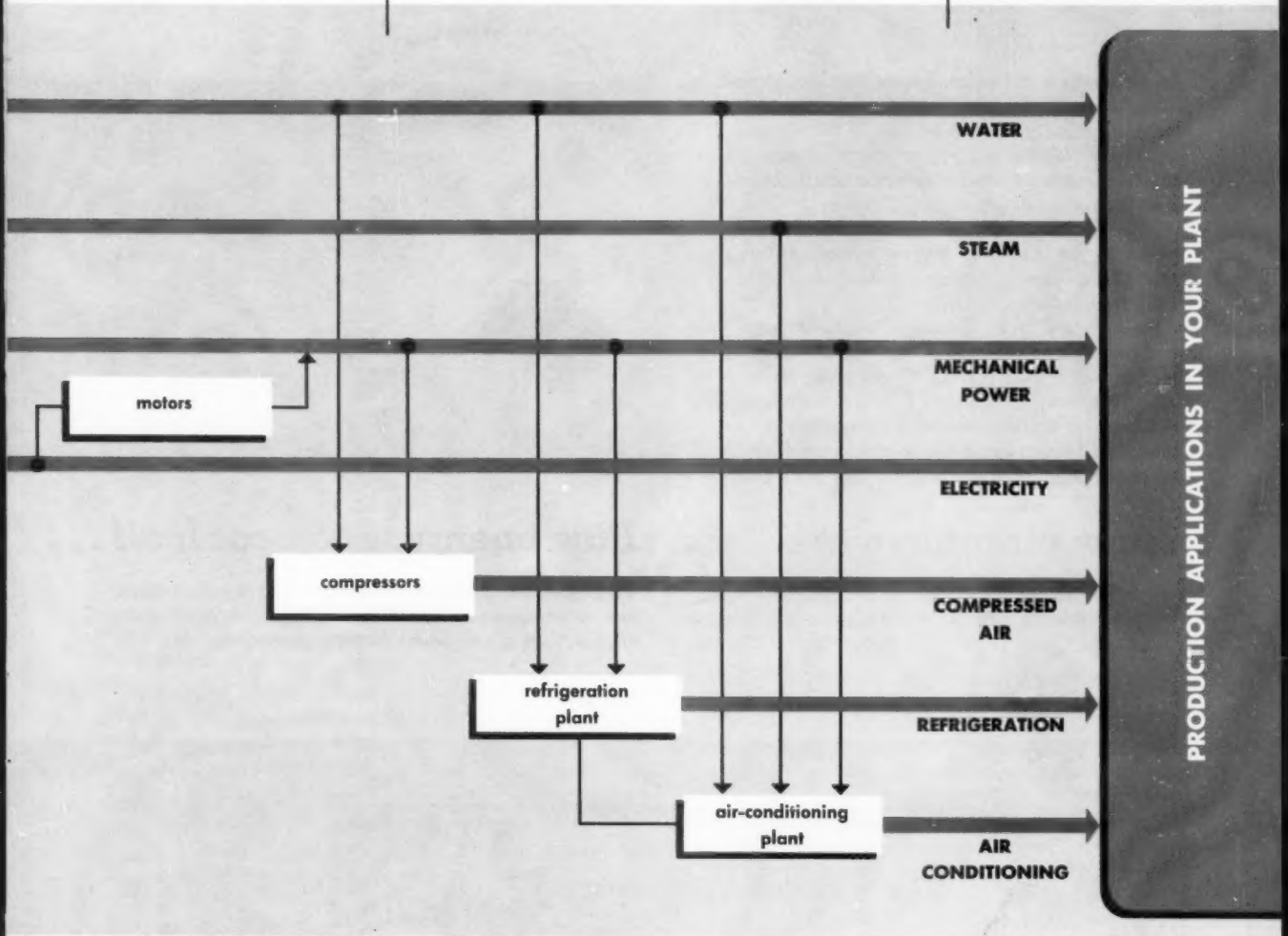
The protection services include housing and "housekeeping," general maintenance, lubrication, fire protection and other "security" functions.

The energy services, commonly called the *power services*, are listed and charted above in highly simplified form. In themselves they make up a complete and logical package ideally suited for separate considera-

motors convert electricity to mechanical power, to drive production machines, and help generate . . .

3 derived services: *compressed air, refrigeration* and *air conditioning*. All take water and mechanical power (usually from motors). Air conditioning consumes steam and refrigeration as well. So . . .

7 power services energize all the equipment in America's industries and institutions



tion by management—a fruitful area for profit seeking.

Note that all involve energy, that all require a similar kind of technical know-how, that all intertwine (as one service is used in generation of another), that all flow to production through a complex arterial network of pipes, conductors, etc, and that all combine to form a single, natural managerial entity.

And note, particularly, that the power services, as a group, involve important capital investment.

For these reasons, clear thinking and effective executive action is best served by treating these services as a single unit. That is why this report concentrates on the power services exclusively, leaves for another time consideration of such vital protection services as general maintenance and lubrication.

In addressing this report primarily to top executives, who are not assumed to have special knowledge of power-service technology, we speak also to the engineers who are the regular readers of POWER.

They will gain, we feel sure, from viewing their jobs in broad perspective and will welcome this opportunity to tune their thinking to the thinking of dollar-conscious executives.

Talking the same language, both groups can work harmoniously and effectively to realize the full potentials of efficient, soundly managed power services.

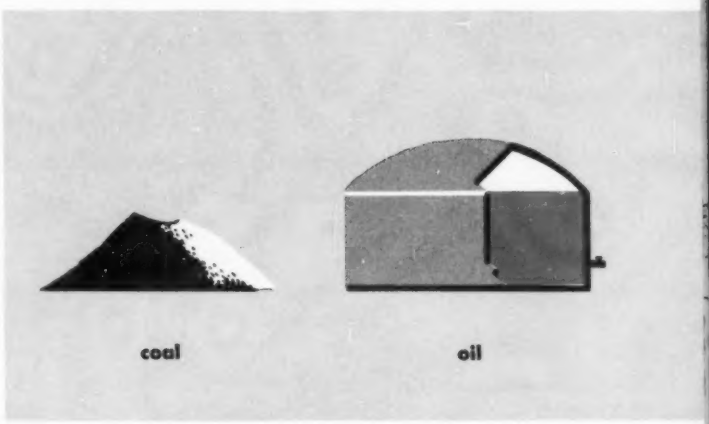
More about each service on following pages ▶

steam . . . chief among the carriers of energy

As we've seen, all seven power services stem from the raw chemical energy in fuels, and from the highly refined energy in purchased electricity. By far the major share of energy entering America's industries and institutions is in the form of fuel.

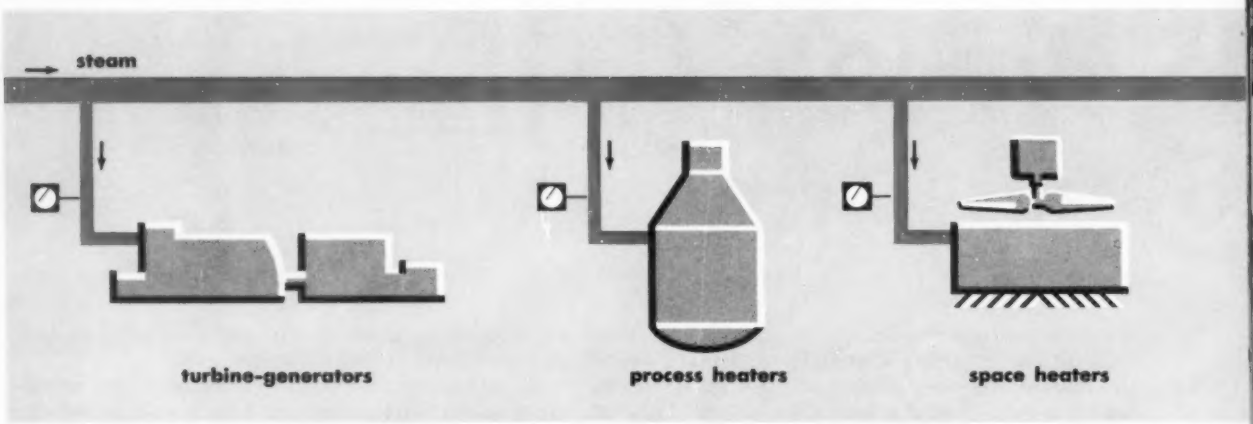
Most of the coal, oil and natural gas for which industry spends several billion dollars annually is converted to steam—industry's No. 1 internal carrier of energy.

Fanning out from the boiler house through a network of piping, this vaporized energy-bearing water has merely to condense to release 1000 heat units per lb to warm buildings and heat an endless variety of processes. Expanding to lower pressure, it makes mechanical power and often can still be used for heat.



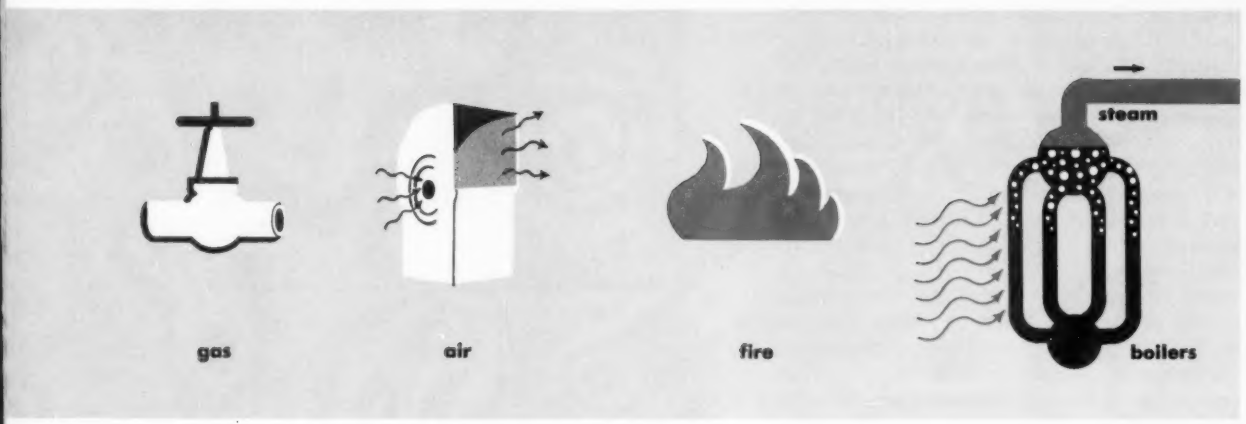
Raw energy . . . coal, oil . . .

The three major steam fuels are coal, oil and natural gas, selected according to comparative over-all cost, allowing for convenience factors like cleanliness.



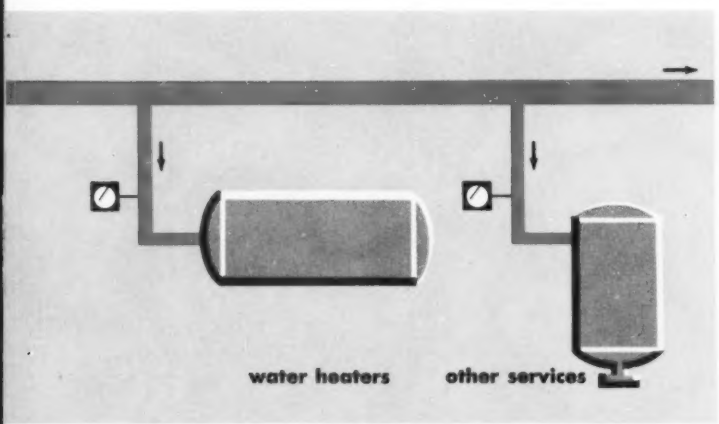
so steam can make power . . . supply heat to buildings . . .

A minor fraction of industry's steam is "expanded" through steam turbines or engines to generate mechanical (and electrical) power. Some serves air-conditioning units. But most of steam generated goes directly from boilers to three types of heating applications: space heaters, water heaters, various processes.



. . . or gas . . . plus air . . . makes fire . . . to evaporate water . . .

Draft fans supply 10 to 20 tons of air, precisely controlled, per ton of coal or oil. Well-mixed and ignited, fuel and air combine chemically (burn). Heat of the fire passes through metal surfaces in boiler to vaporize water, making steam at any desired pressure from atmospheric to more than 1000 lb per sq in.



. . . and production processes

A major part of all the energy units consumed by American industry and institutions is in the form of steam delivered to space, water and process heating.

Dollar tips: Old boiler-house methods waste manpower, limit range of fuels that can be burned. Mechanized handling and automatic combustion control, even when applied in existing setups, cut labor costs drastically.

New or modernized firing equipment and furnaces not only reduce fuel consumption, but they also permit using lower-cost grades.

Even in well-run plants, wasteful practices in distribution and use of steam can be amazingly costly. Control waste by metering steam use and charging the using departments.

Expert surveys (often a joint effort of plant staff and outside consultants) turn up enough low-cost improvements to pay for themselves quickly—usually less than two years. And they reveal profitable major projects.

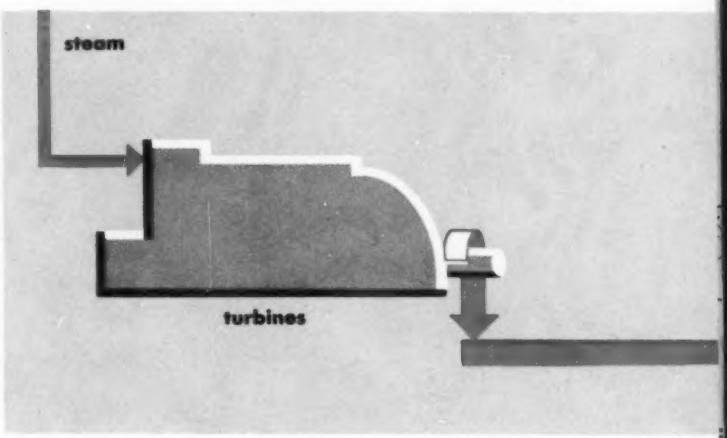
. . . next is mechanical power

mechanical power . . . the service

Whenever an actual push, pull or twist (torque) is involved, we see mechanical power at work. First made from blowing winds and falling water, mechanical power came into its own with the steam engine, and later the internal-combustion engine, which converts fuel to power in a single step.

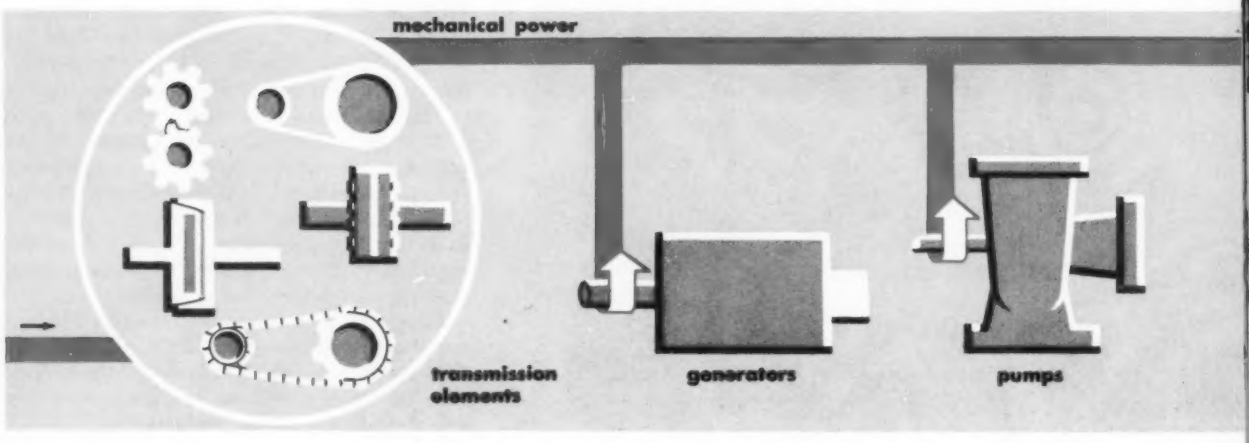
Today, mechanical power finds its greatest usefulness teamed with electricity. It spins the generators that make that easy-to-distribute form of energy. Then, at myriad points in the working areas of industry and institutions, motors convert the electricity back into the mechanical power we need to turn the wheels.

Mechanical - power - transmission devices connect these motors to power-service units like pumps, and to production units.



Turbines expand steam . . .

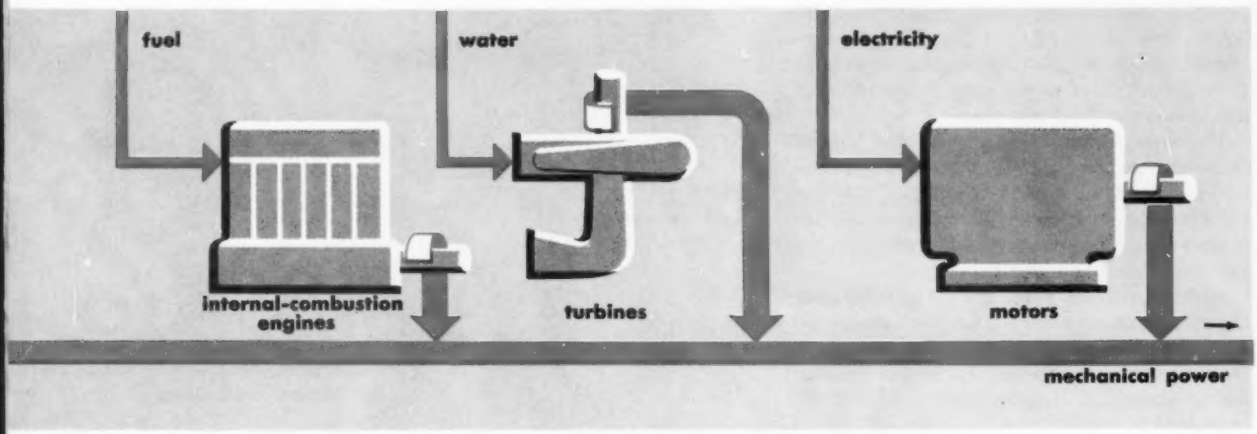
Steam expanding from high to low pressure in an engine or turbine generates mechanical power at its shaft coupling, for close or distant application.



mechanical power for delivery to generators . . . pumps . . .

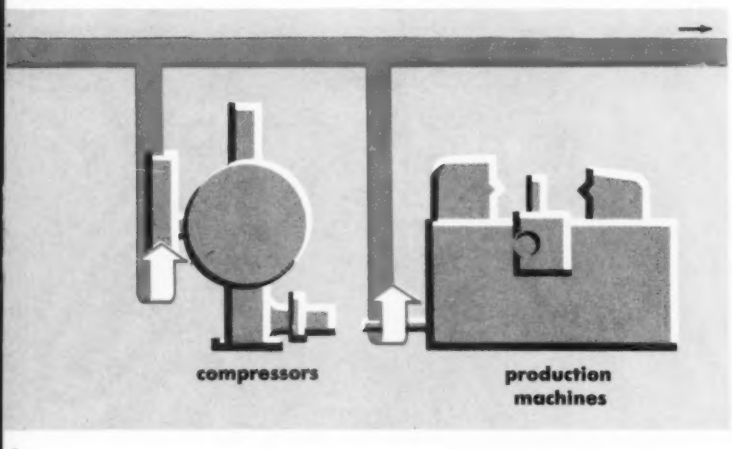
Mechanical-power-transmission equipment — couplings, shafts, pulleys, belts, gearing, chain—connects point of generation with point of use. Equally important, it adjusts characteristics of the driver (speed, etc) to needs of driven machines. These include power-service units like generators, pumps, compressors.

that turns all the wheels of the nation



. . . other units use fuel . . . water . . . electricity . . . to make . . .

Internal-combustion engines produce mechanical power directly from burning fuel, and hydro turbines produce it directly from water falling to a lower level. By far the most widely used means of producing mechanical power is the electric motor, which turns electricity into mechanical power anywhere it's needed.



. . . compressors . . . production

But the biggest application of mechanical power is to production. Motors on production machines are by far the most important producers of mechanical power.

Dollar tips: Mechanical power always involves motion, force and friction—meaning also wear, power loss and maintenance. The dollar objective is to minimize these by establishing sound systems of maintenance and lubrication and by eliminating sources of recurring trouble and expense.

For economical, trouble-free performance, motors and mechanical-transmission equipment must match driven machinery. Make sure the technical skill to do this is available in your organization and is put to work.

Similar engineering know-how is required to insure high efficiency in the engines and turbines that generate mechanical power and in the pumps, compressors and generators that convert it to other power services.

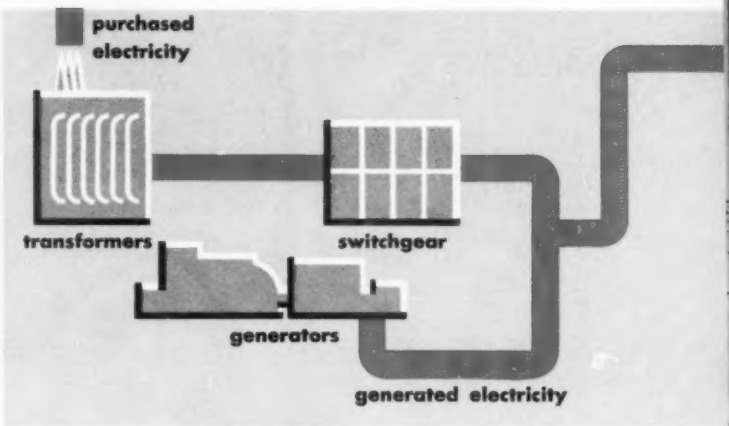
. . . next comes electricity

electricity . . . highly convenient and versatile,

In form, transmission and application, electricity is most versatile of the power services. Purchased, or privately generated, it fans out through the plant to be stepped down to final-use voltage at load centers.

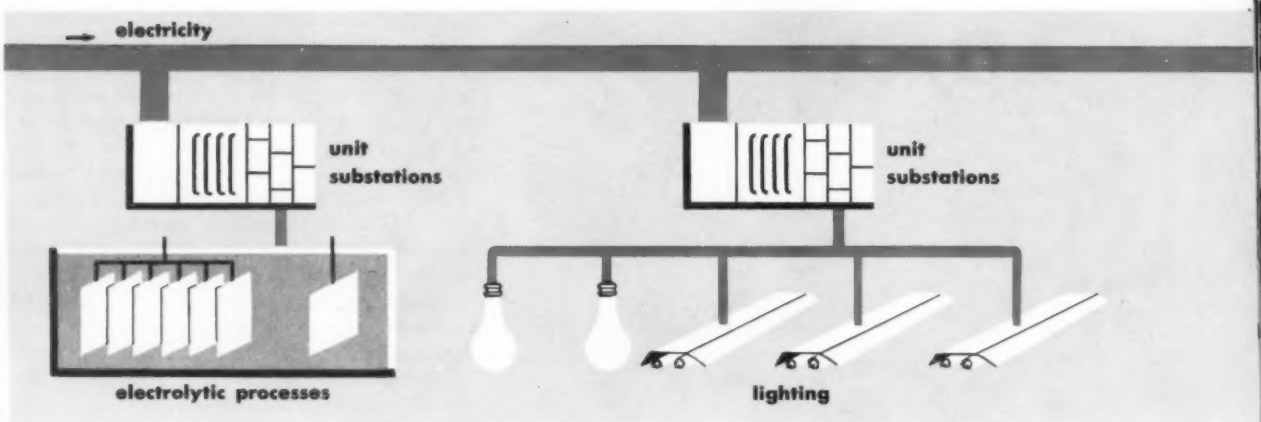
It feeds production with readily controllable energy for heat, light, electrochemical and electrometallurgical processes. And, most important, for motors that produce the ultimate mechanical power to turn the wheels of our industries and institutions.

Although today's electricity is often purchased, there are many situations where private generation by oil or gas engines, or by steam, proves economical. Typical is the plant where steam for process can be passed first through a turbine to make "byproduct" power.



Electricity, bought . . . made . . .

Most electricity used in industry and institutions is purchased and stepped down to plant-voltage level. Where economics warrant, electricity is plant-made.



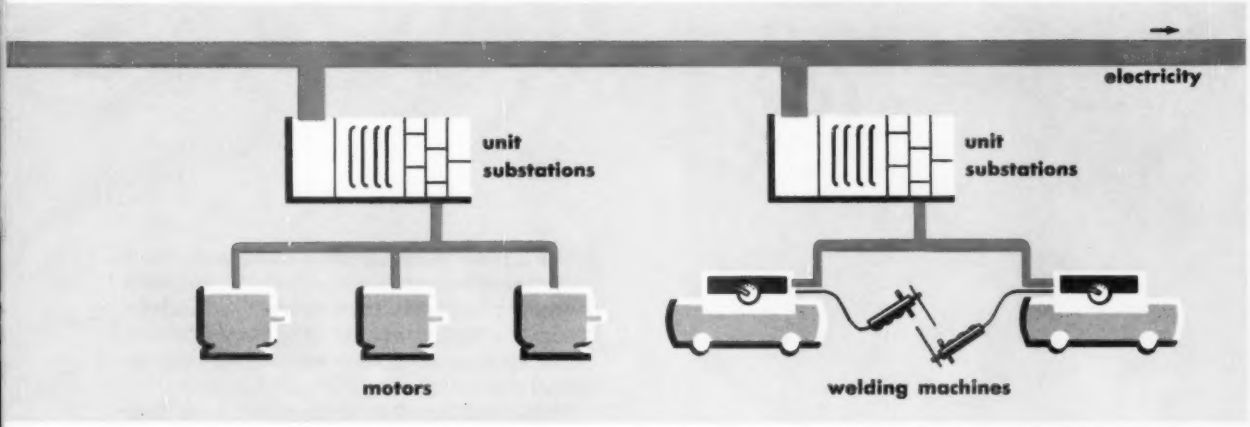
electrochemical processes . . .

Electricity is an important ingredient in products like chlorine, made by electrochemical methods, and in electrometallurgical ones like aluminum, magnesium.

plant lighting . . .

Today's higher standards for illumination in industry and institutions make electricity for this purpose increasingly important despite more-efficient lamps.

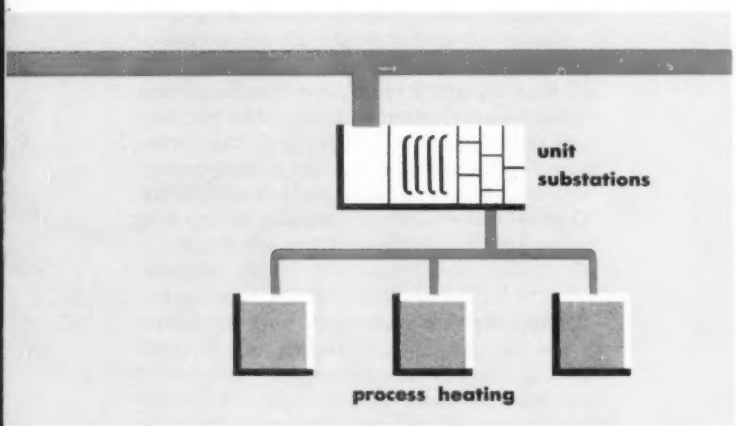
it drives motors, supplies light and heat



. . . feeds through plant to motors . . . welding equipment . . .

Most important application of electricity is to millions of production and service motors ranging in size from fractional to many thousand horsepower.

Electric welding—arc and resistance types—has revolutionized the entire business of fabricating metals. It is an important consumer of electricity.



. . . and special heating jobs

Being a highly refined form of energy, electricity is used for such special heating applications as induction hardening, infrared baking and drying.

Dollar tips: Make sure you're procuring electricity in the most economical way. If buying is the answer, see that you get the best available rate setup—there are rate specialists you can call on for needed advice.

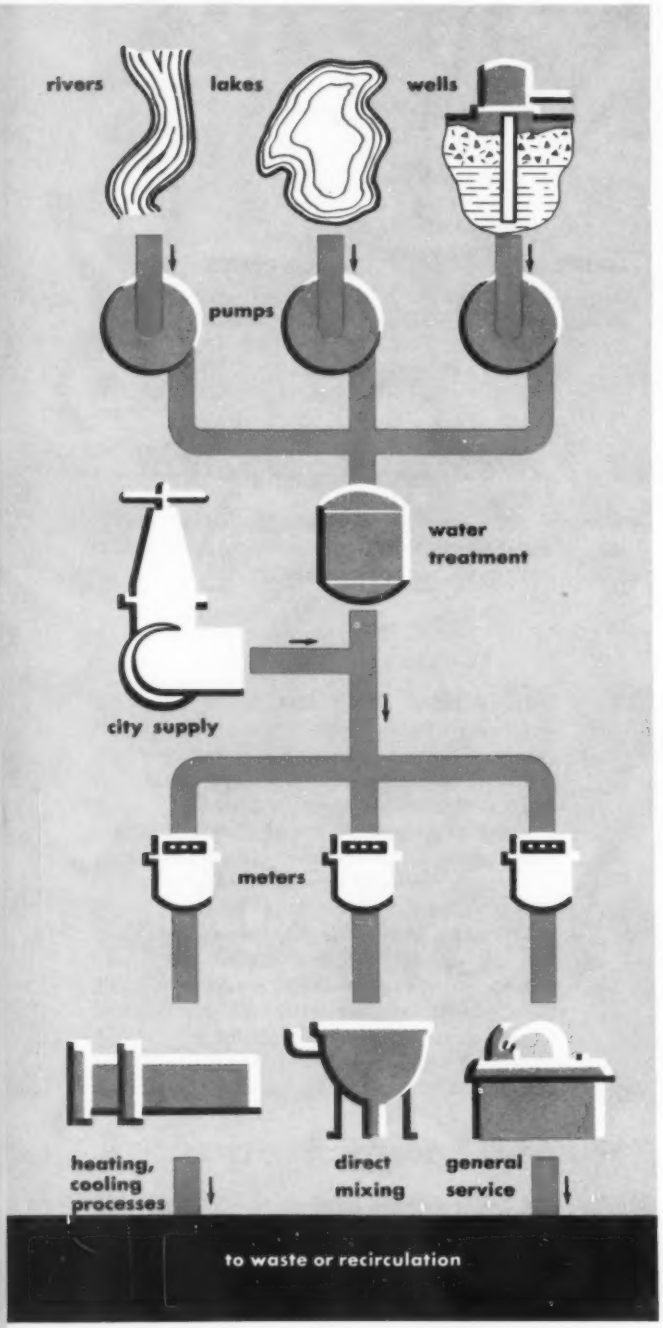
Many of today's electrical distribution systems are obsolete—wasting money and, more important, blocking expansion of production facilities and risking electrical failures.

Modern systems, using higher voltages and unit substations, cost less, expand easier, and provide more safety margin. A survey to bring your system into line with best practice will pay present and future dividends.

As with other services, metering and charging keep waste of electricity under control.

. . . next: wafer, compressed air

water . . . an indispensable power service



As a basic power service, water is far more than the simple substance H_2O. Rather, this water is pumped, suitably conditioned and delivered to a great variety of plant productive uses. Dollarwise, it is often second only to steam and electricity.

While industrial executives recognize that ample water supply is essential, many fail to appreciate the technical complexity and dollar importance of *water management*.

Service facts: Some plants develop their own sources—rivers, lakes, wells, etc—pumping and treating the water as required. Others depend on city supplies. Some do both.

Although we think of sanitary uses first, biggest water need is usually for cooling, heating. It may also go into the product.

Nature of use strongly affects choice of source and setup of distribution system. If big need is cooling, for example, salt water, or even treated sewage-plant effluent, may be used, with cooling system segregated from other uses. Cooling towers may play a big part in such a system, as may re-use, or multiple use. Most expensive mistake: bringing all water up to quality requirements of one minor use.

Dollar tips: Expert water surveys, a must before any major move, pay in existing plants as well. They answer these questions: Are you using lowest-cost source or sources? Are you getting full benefit of automatic controls, evaporative-cooling equipment, multiple-use hookups, and other engineering devices for water conservation? Are your plant supervisors controlling water waste?

Don't overlook waste disposal: Even if the law doesn't require treatment, it's good public relations and often recovers usable water (sometimes valuable materials also).

handy power in pipes . . . compressed air

Compressed air, a piped service, is easily converted to mechanical power. This explains the major part pneumatic tools play in modern production. Light, hose-fed, portable, they give the worker an extra arm—a strong one.

In many industries, compressed air powers large hammers and presses, serves on today's machines for handling and clamping the work, conveys bulk materials. And in instruments and control systems air is often the actuator.

Service facts: Intake brings in clean and, preferably, cool air. Compressor raises air pressure (to 100 lb per sq in. in most shop systems) and delivers to receivers. These act like flywheels, absorbing variations in demand. Piping takes air to points of use. Failure to keep pipe and hose amply large, right out to the tools, cuts pressure and robs tools and workers of their full effectiveness.

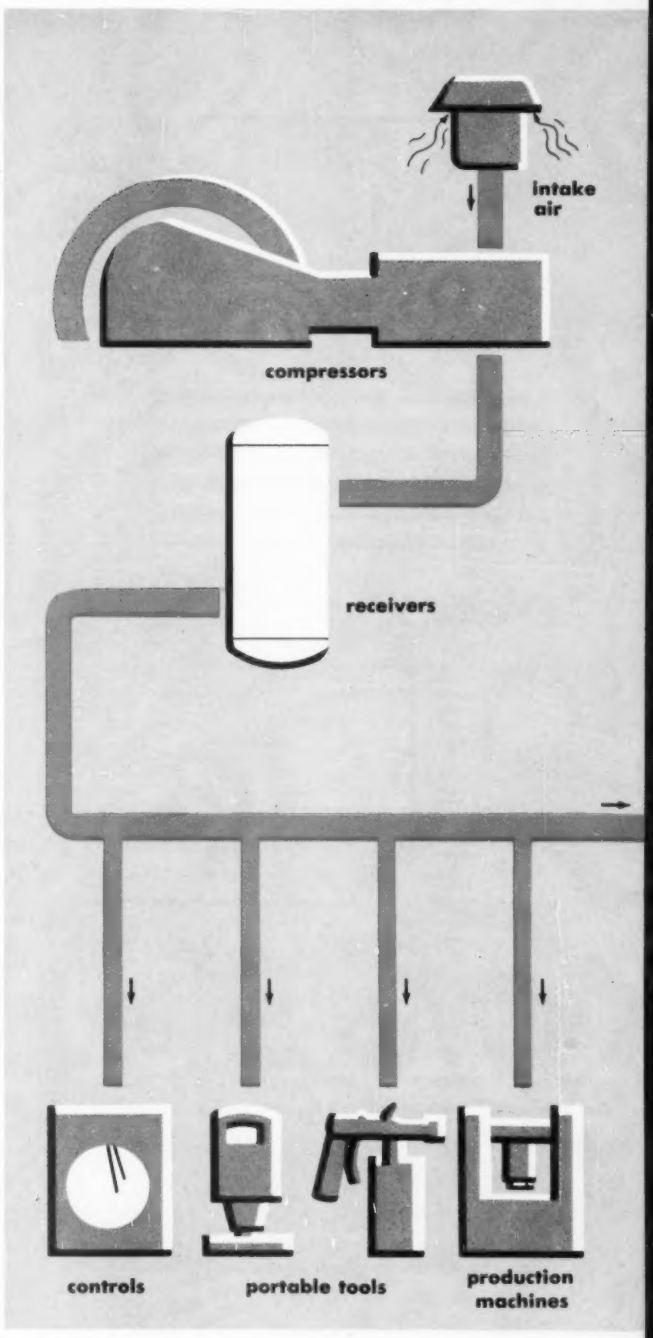
Compressors may be located at a single, central point and the air piped throughout the plant. In many of today's plants, smaller units are spotted at production centers, each serving a "local" distribution system.

Dollar tips: It goes without saying that compressed air should be generated at lowest cost. But don't stop there—the really big savings are in distribution, application.

Leaks are an obvious source of loss but if neglected can add to an impressive dollar total. Total leakage is easily checked with all load off system and outlets closed.

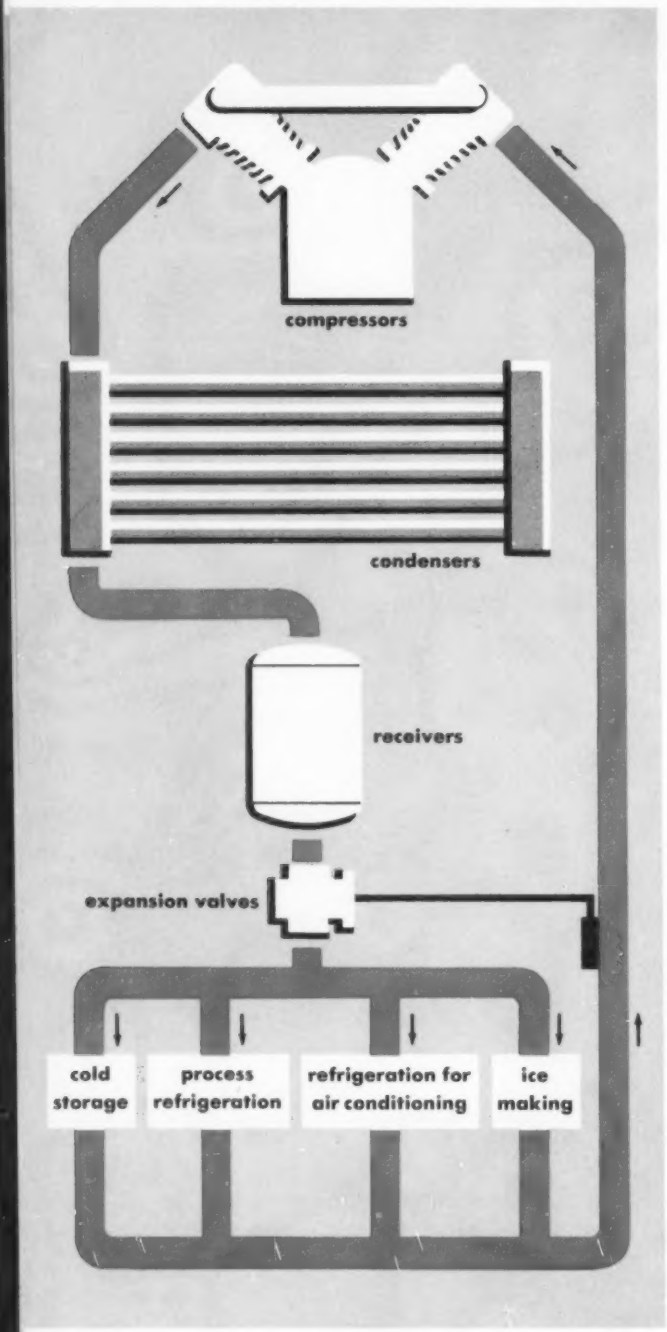
Less obvious, but vastly more expensive, is inadequate pressure at tools and machines. This is a direct loss of precious man-hours.

Finally, take steps to guard against all forms of wasteful use. Because it's handy, and apparently free, compressed air gets used for all sorts of things, even ventilation.



. . . and finally come refrigeration and air conditioning

refrigeration . . . "piped cold" on the job



Viewed as a power service, refrigeration is merely "cold" or "heat-absorbing capacity" piped around the plant to points requiring cooling. Medium conveying this cooling effect may be chilled water, brine (for temperatures below 32 F) or the refrigerant liquid itself. Refrigeration is often generated at the using point to minimize distribution costs.

Newer low-temperature refrigerants have unveiled many economical uses of this service. Hardening of metals, stabilizing of steels, and shrink fitting, to mention just a few.

Service facts: To understand how we generate refrigeration watch a pot boil on the gas range. Boiling at 212 F and at atmospheric pressure, water draws its heat from the flame. Thus it actually cools or "refrigerates" the flame. Broadly speaking, any boiling liquid is delivering refrigeration. Commercially we restrict the term to cases where boiling takes place at low temperature without requiring excessively low pressures.

Let's follow the process with Freon-12, a commercial refrigerant. Compressed to 100 lb per sq in. and cooled by water or forced-air draft, Freon-12 vapor is liquefied in the condenser. It then passes through an expansion valve where pressure drops to, say, 30 lb per sq in. and temperature to 32 F. Liquid refrigerant, absorbing heat from its surroundings, starts to boil. Resulting vapor is recompressed and liquefied for a new cycle.

Dollar tips: Biggest slice of operating cost goes for compressor power. Keeping it to a minimum is the job of properly set temperature controls. Don't peg them at a lower temperature than you absolutely need.

Well-insulated piping and equipment quickly pay for themselves by cutting "cold" waste.

In larger installations cooling-water costs can be a big item. Cooling-tower or evaporative-condenser systems conserve water by re-use. They can trim water bills as much as 95% if you now use a once-through system.

for tailored climate . . . air conditioning

Conditioned air is air cleaned of undesired impurities and processed to the required final temperature and humidity. It may be produced centrally and distributed, or electricity may be fed to self-contained units in using areas. An intermediate arrangement conditions air locally, but uses centrally produced raw materials—electricity, heat and refrigeration.

One of the fastest-growing services, conditioned air for both comfort applications and control of product quality, has blossomed into a major American industry.

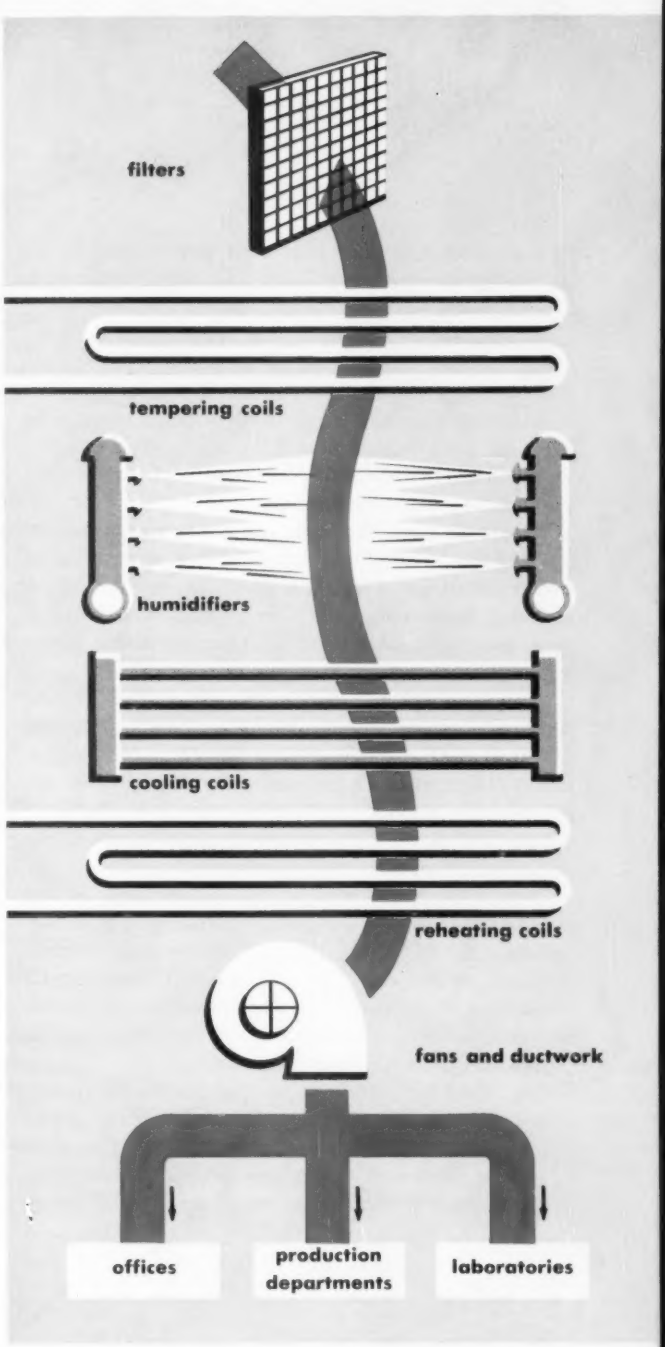
Service facts: Basic steps are cleaning, heating, cooling, addition or removal of moisture, and blowing the conditioned air through ductwork. In a year-round system, tempering coils make sure incoming air is above freezing point. Spray humidifier adds moisture to air in winter months and dehumidifies in summer. Following moisture-control stage, air temperature is set with cooling or reheating coils. By-pass controls, around the various elements, suit this versatile power service to a wide range of temperature and humidity conditions.

Common practice, particularly in large installations, produces refrigeration and chills water at a central point. Actual cooling of air stream is done locally, where conditioned air is needed, by closed coils carrying chilled water. Piping being relatively easy to install, such systems prove flexible in layout and ideally suited to large jobs.

Dollar tips: This service is sometimes set up by outside experts working with the plant staff. Initial design, including temperature and humidity limits, is important. Conditions selected greatly affect operating costs.

As with refrigeration, properly installed and set controls keep electrical power costs for this service to a minimum.

After the system is set up, make sure engineers initiate a point-by-point program of routine maintenance. Relatively little effort here prevents expensive outages.



. . . now let's view the services at work

How flowing energy serves industry

It is now clear that the seven power services are *energy flowing* out through an arterial network to vitalize every industrial plant and institution.

So far these services have been presented in idealized form. We have omitted technical details to make clear the simple logic of all power-service systems.

Now the time has come to view these services as they appear in actual plants. To convey this *feel* of a real industrial installation the editors of POWER present the facing insert drawing.

This is not a specific plant, nor even a specific industry. Rather it combines elements that are typical of many industries. The units shown represent heaters, machine tools, stills, tanks, conveyors, ovens and a great variety of other equipment for processing, forming and conveying.

Steam, electricity and water are shown flowing through plant-wide networks, as is common in actual industry. And of course energy flows through institutional plants in much the same way. Compressed air, refrigeration and air conditioning have been localized. Mechanical power transmission appears as vital links between driving and driven machines.

Electricity is pictured as being generated at the plant site as well as purchased. Whether you generate, purchase, or do both is largely a matter of economics.

Water service can also be bought or "generated," depending on economic and technical factors. Pump and water-conditioning building shown gets raw water, pumps and processes it for plant use.

The block of buildings at the left is commonly called the "powerhouse"—meaning the boiler plant plus the turbine plant, if any, plus the substation used to receive purchased electricity. Although this central generating plant has major importance, the drawing purposely emphasizes the less obvious functions of distribution and application—for all seven services.

It also makes clear the fact that *generation* often takes place outside the powerhouse.

The complete ensemble, from incoming fuel to service application, is the true *power-service plant* as distinguished from the localized *powerhouse*. Some will prefer to call it by other names, such as the *plant utilities* or *power-service system*.

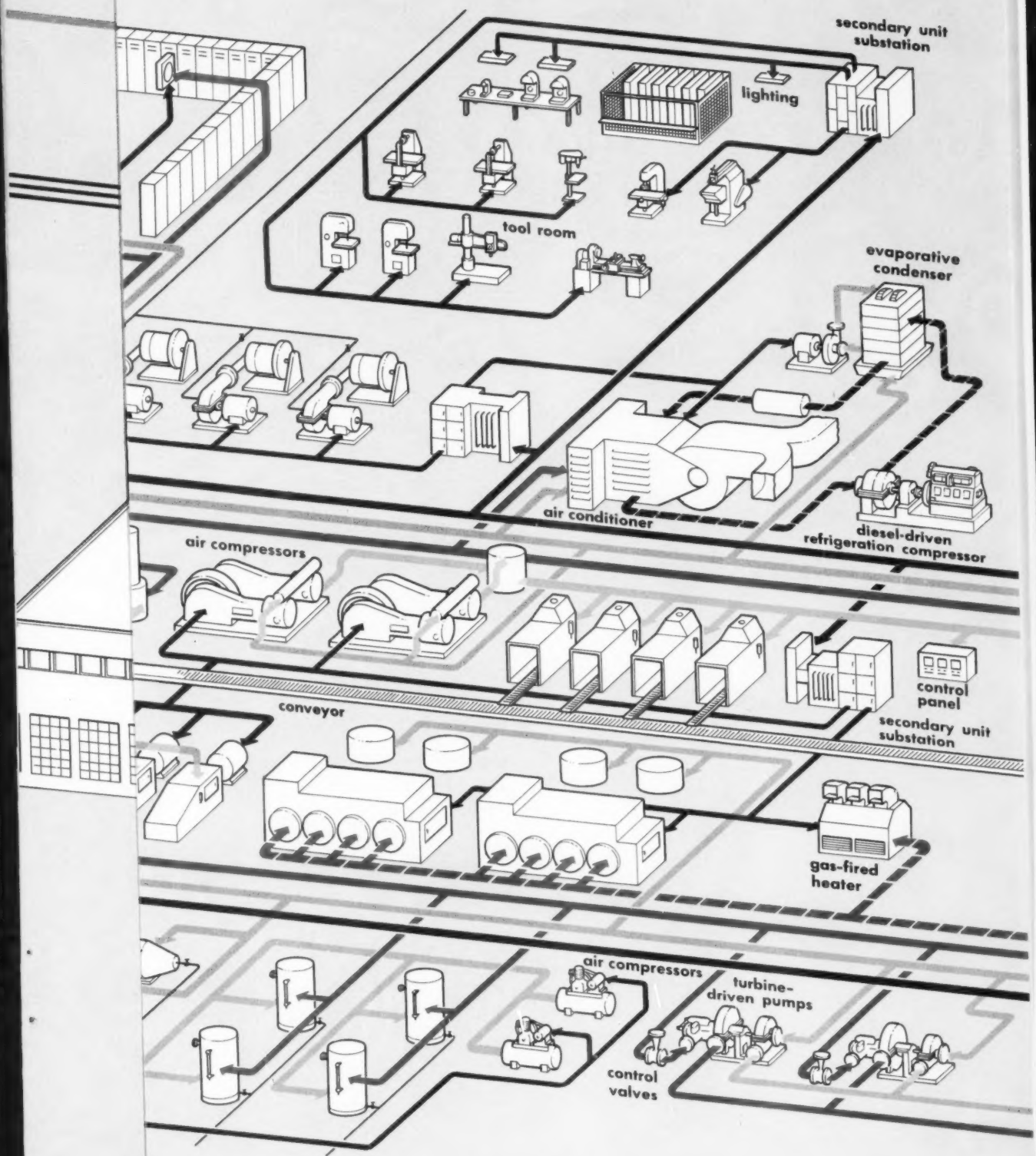
Whatever its name, this complete power-service system — generation, plus distribution, plus application of all the services — is what we are talking about throughout this report to America's executives.

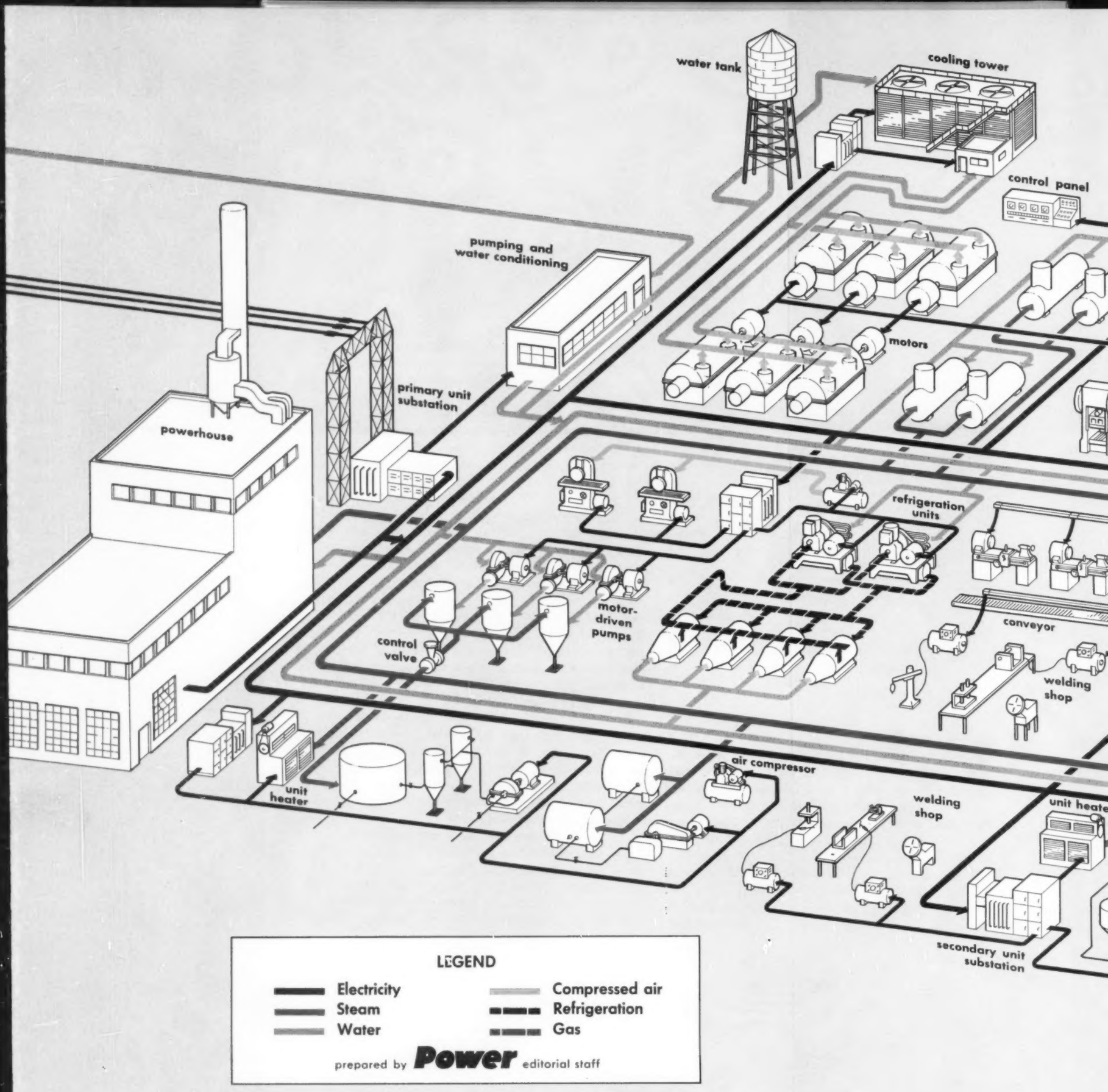
WHETHER viewed schematically, or in an actual plant, the power services—water, steam, mechanical power, electricity, compressed air, refrigeration and air conditioning—all involve energy flowing out through the plant to serve production.

One service is the raw material of others so, by their very nature, the services are a single bundle.

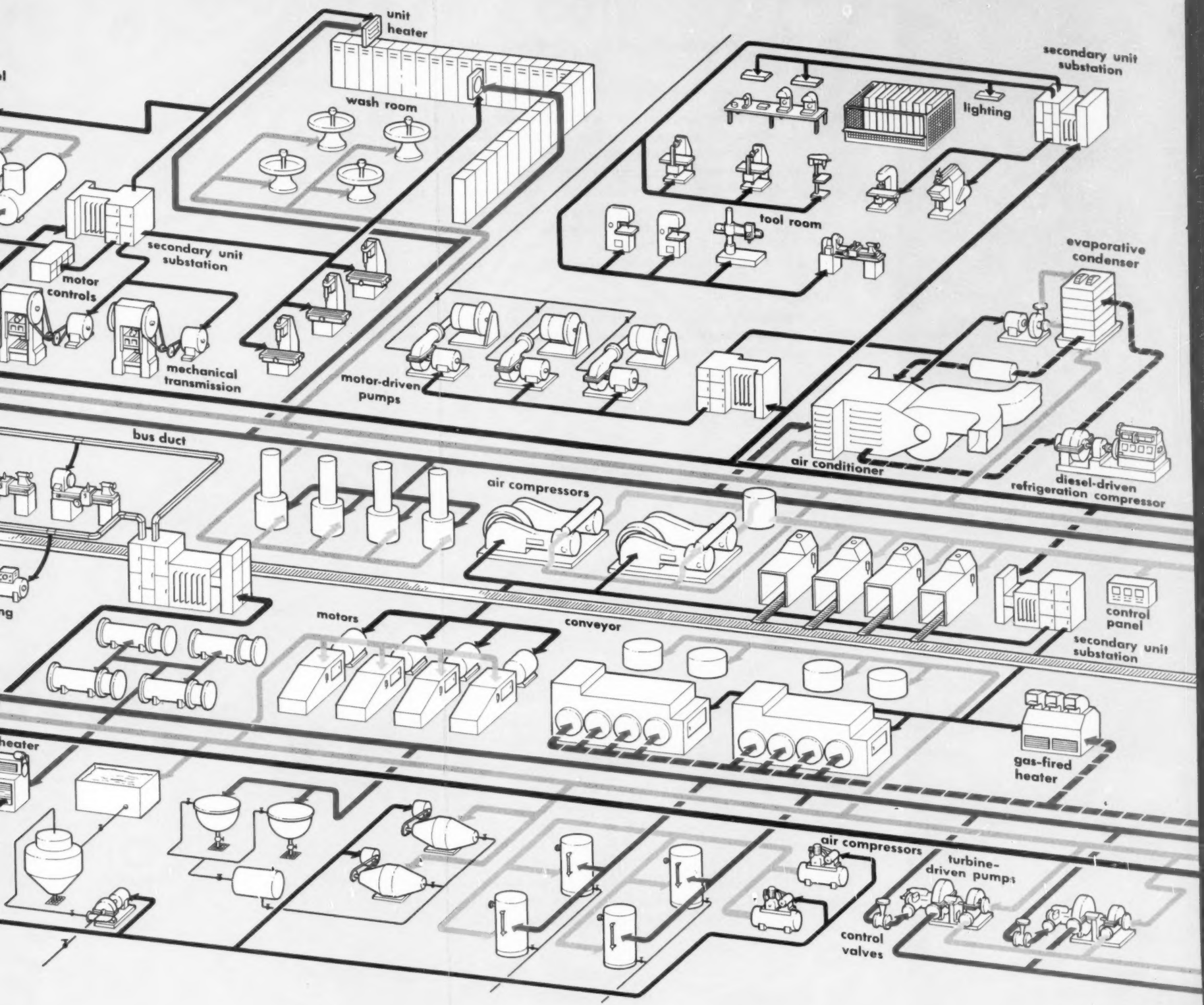
Thus far we have pictured industry's energy system in purely material terms without regard to the men who run it or the methods of management. With this essential background we can now face the problems of power-service management with an eye to profits.

How flowing energy serves industry




water tank
cooling tower
control panel
pumping and
water conditioning
motors
primary unit
substation
powerhouse
refrigeration
units
motor-
driven
pumps
control
valve
conveyor
welding
shop
air compressor
unit
heater
welding
shop
unit heate
secondary unit
substation
LEGEND
Electricity
Steam
Water
Compressed air
Refrigeration
Gas
prepared by Power editorial staff

How flowing energy serves industry



Now what about . . .

men . . . management . . . money?

The preceding pages have given a general picture of the power services for the executive who proposes to play his full and proper part in the guidance of his power-service managers, engineers and other supervisory personnel.

So far, we've talked almost exclusively of the services themselves, in material and energy terms. The dollar angle has been mentioned only incidentally, and the human factor hardly at all. In the 15 pages that follow we turn from the inanimate elements that are to be managed, to the central executive problem—how to direct this complex system, with due regard to all the human factors, toward maximum economic performance. Namely, the long-term profitable operation of the business or institution.

The ideas and recommendations to be presented in the following pages sum up a whole generation of intimate contact with power-service organizations from coast to coast. And the broad conclusions from this long experience have been rechecked by a field survey of more than 100 industrial and institutional plants.

The practical philosophy of power-service management will be unfolded along these lines:

What is managed

Basically the power-service job is clear cut. But the actual pattern of management varies from plant to plant and from industry to industry.

Who is involved

About the men who actually run the power services. Both in-plant and outside help — who they are — how they share responsibilities and complement each other.

First principles

A practical power-service-management philosophy for executives. Based on the actualities as observed in a variety of industries and institutions.

Outside help

Effective power-service management will use every available aid to profitable operation. Special problems are often best met with help from consultants and other outside professional assistance. Where to turn and how to proceed.

Dollars

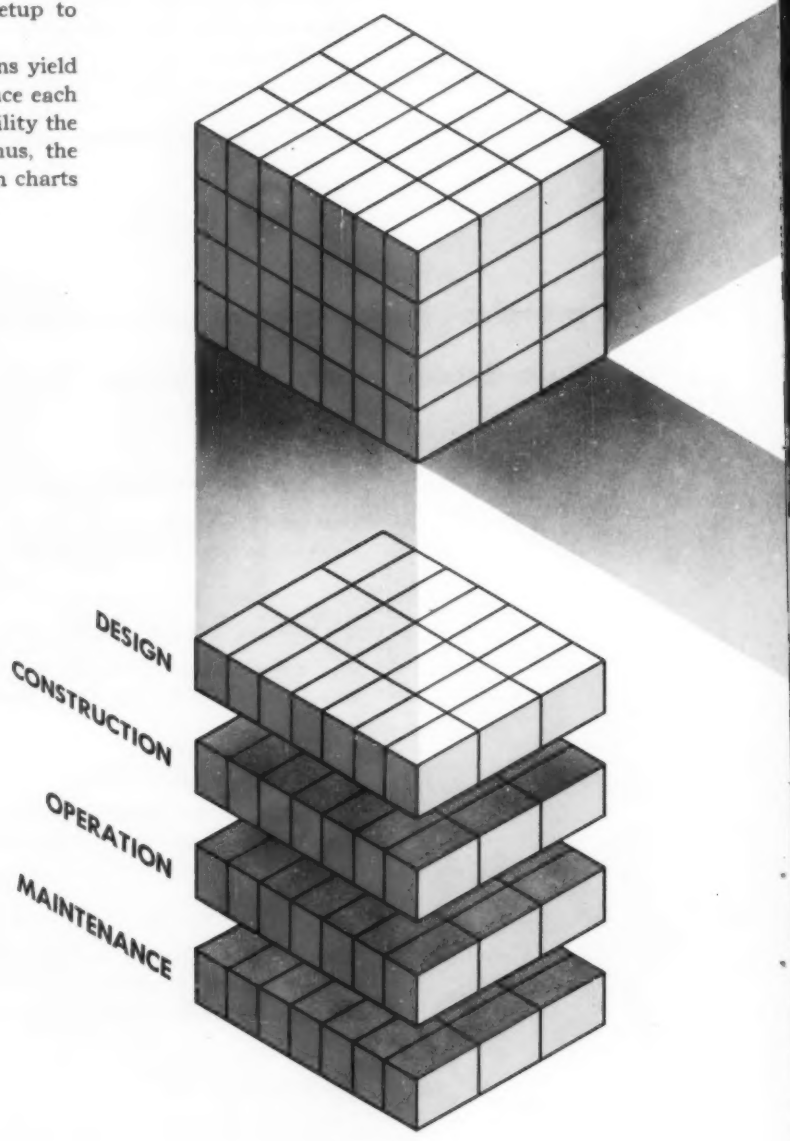
A final quick look at the sign posts along the road to power-service profits.

the power-service job . . . is clear cut

This simple cube includes all the elements found in any power-service system—in any industrial or institutional plant. Its dimensions are (1) services (2) functions and (3) stages.

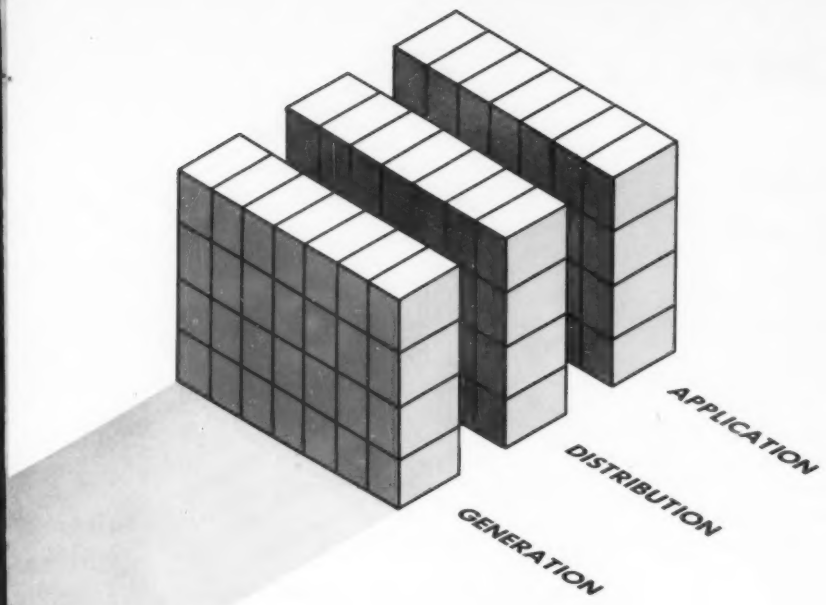
The exploded views point up the simple logic that underlies seemingly complex organization patterns. They are actually the starting point of all plans for organizing or reorganizing a power-service setup to suit your plant.

Note that 7 services × 3 stages × 4 functions yield the 84 elements of the power-service cube. Since each of these is an assignable managerial responsibility the possible arrangements are almost infinite. Thus, the immense variety of power-service organization charts from plant to plant.



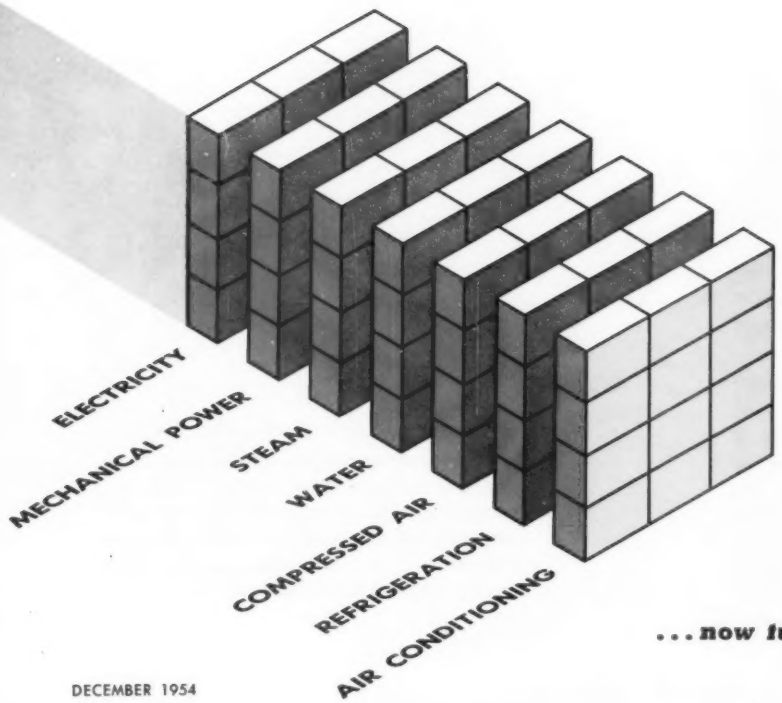
4 functions

Each of the 7 power services, in each of its 3 stages, represents an array of physical equipment. To bring this into being, and to keep it in effective service, takes 4 closely related functions: design, construction, operation and maintenance.



3 stages

As we've seen in the first half of this report, each power service, from raw material to finished product, is handled in 3 stages — generation, distribution, application. We use the word *generation* in its broadest sense — processes that produce usable forms of energy. Thus, compressing air, pumping water, etc., are generating stages.



7 services

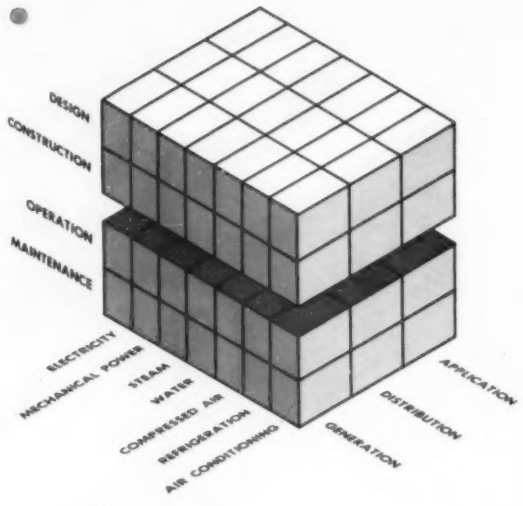
Some of these services are found in every industrial and institutional plant. Many plants use all of them. In their entirety they represent a sizable capital investment. They also represent an opportunity for smart management to increase productive efficiency, maximize its profits.

...now turn to actual arrangements

patterns vary...

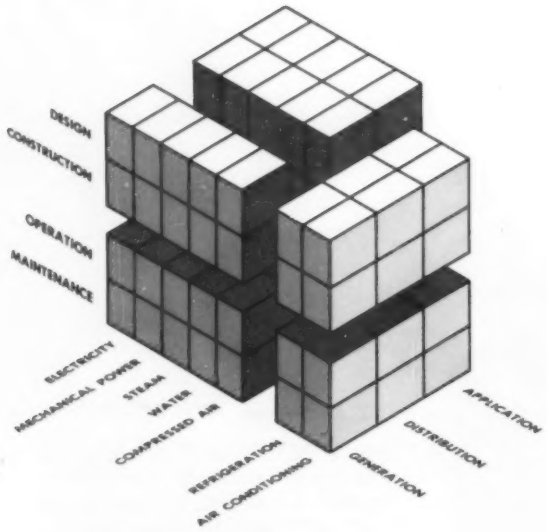
from plant to plant and from industry to industry

Although the basic pattern of the power services is simple, the 84 elements pictured on the preceding two pages can be combined in many ways for the assignment of managerial responsibility. These examples from specific plants are not intended as a standard for the particular industry. They do illustrate, however, a few typical ways the power-service manager may delegate his various responsibilities while still retaining over-all control.



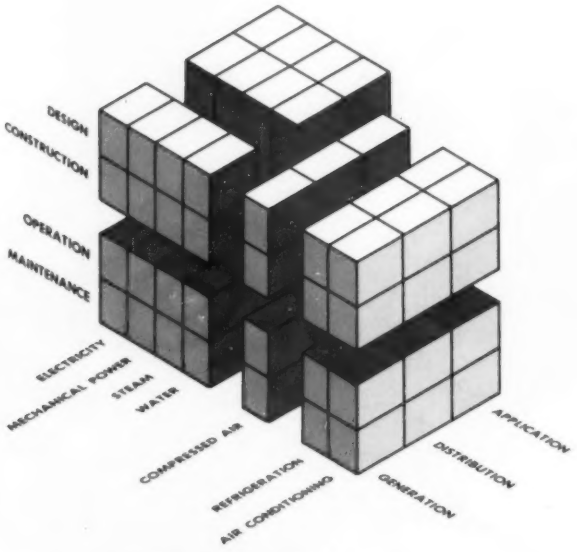
a hospital

Major design and construction projects are handled by outside engineering firms. Hospital's chief engineer takes charge of operation and maintenance, from raw materials to finished-product services throughout hospital.



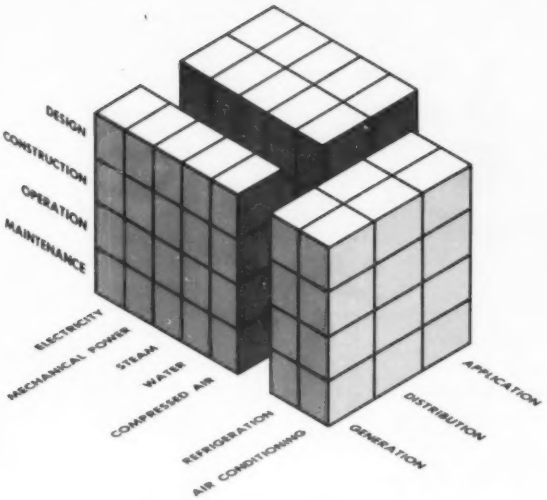
a textile mill

Refrigeration and air conditioning, especially for clean air and humidity control, play a big part in synthetic-fiber processes. Thus, these services are separate divisions. Outside firms do design and construction of all services.



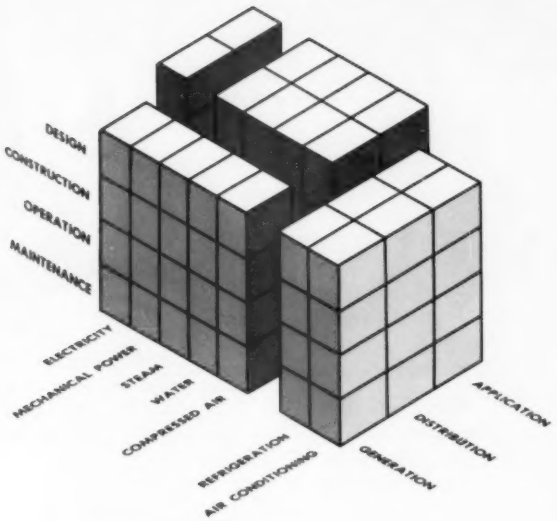
an aircraft plant

The managerial setup is the same as for the textile plant except that the power-service manager assigns the generation, transmission and application of compressed air as a unit responsibility because of the many air applications.



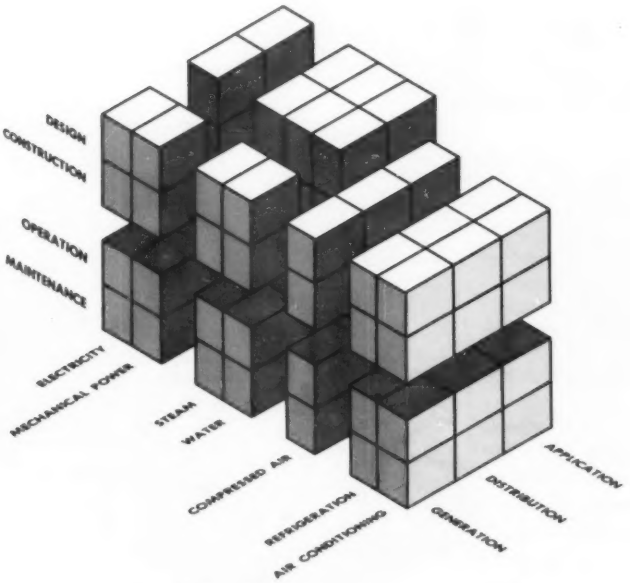
a metal-working plant

With all services under one manager, immediate responsibility for air conditioning and refrigeration is separate. For other services, generation is split from distribution and use. Plant also does its own design and construction.



a metals refinery

Setup here is similar to the metal-working plant except for electricity. Because of extensive use of this service for electrolytic refining the power manager makes one supervisor responsible for its distribution and application.



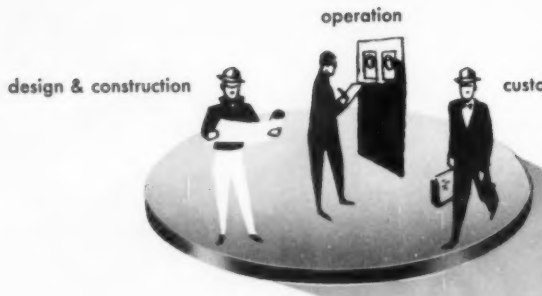
an oil refinery

Because certain services are here used on a vast scale the power manager further subdivides responsibility. In this big plant, water and steam generation are assigned to one assistant, mechanical power and electricity to another.

We could go on almost indefinitely citing variations found in actual plants. Often the organizational pattern has been built up around a key individual. In some cases tradition of the industry has largely set the management pattern.

Most effective results are achieved when the structure evolves from an actual study of all power-service operations and the personnel available to carry them out. Review of the plan from time to time will keep it from becoming obsolete in the face of new situations.

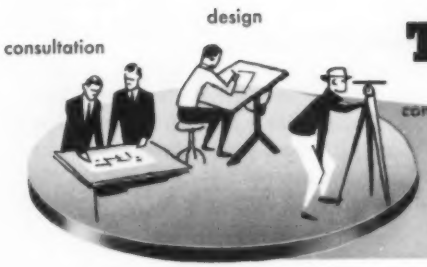
....next—who makes the pattern work



Utilities

Highly efficient central stations bring cheap power to industries and institutions, and point the way to technical advances. Also advise on power use.

These outside sources help

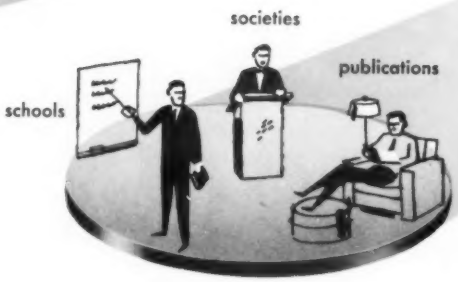


Engineering services

These services of individual consultants and engineering firms include plant studies, plant design and construction — even operating guidance.

Equipment manufacturers

The equipment manufacturer depends on well-satisfied customers. He also knows more about *his* product than anyone. Let him tell you how to use it.



Engineering information

These are the means by which power-service men share the knowledge of other engineers. Management should encourage their use.

Top management

Management integrates the power-service department with the whole enterprise. Supplies informed cooperation, standards and incentives.

Power-service management

Whatever his actual title, the power-service manager is the man who has top responsibility for generation, distribution and use of the services.

inside management achieve . . .

The men behind the power services

This Report to Executives is mainly concerned with the internal aspects of the power services of industry and institutions. But we must not entirely neglect the broad power picture. Here is a bird's-eye view of those outside power groups that render important aid to industrial and institutional power-services everywhere.

Among these groups the utilities are outstanding. Their central stations, which generate the greater part of the electric power consumed by industry and institutions, are also models of advanced engineering practice. This is a double service. The high efficiency of these stations saves users millions of dollars in power bills. At the same time, technical advances pioneered by the utilities pave the way for parallel progress in industry and institutions.

In addition, the power companies offer important advisory service as part of their program to build load and insure customer satisfaction.

No organization can do its best without tapping three other sources of experience and knowledge. These are (1) consultants and construction firms (2) equipment manufacturers and (3) those "common carriers" of technical know-how – the technical schools, the engineering societies and the technical publications.

. . . next come management fundamentals

executive leadership . . . it starts with

AMERICA'S industries and institutions, by and large, do a topnotch job of turning out goods and services. Why, when the same management skills are involved, is the power-service function so often a stepchild? The answer, pointed up by POWER's extensive field surveys, seems to lie in a lack of awareness of the profit potentials of the power services — exactly like those that get keen executive attention in "productive" operations.

Realizing the profit potentials of the power services requires only the exercise of familiar managerial principles. We summarize eight basic ones here, then, on following pages, highlight key points of power-service investment. We wind up with cases showing how these ideas pay off.

1 Get to know how your power-service system works

Naturally, top management need not concern itself with the myriad technical details involved. That's the engineer's job. But a general knowledge of the magnitude of power services, and how they operate, is invaluable to the executive who wants to understand and evaluate the dollar-saving ideas of his power-service men.

In the first half of this report, we've shown how these energy conversions are handled, purposely omitting the fine points. It takes only a little more to enlarge on this basic information — as it applies to your plant. If you haven't already done so, sit down with your power-service manager and talk it over.

2 Develop a smooth-working pattern of organization

The principles that apply to sound organization of the power-service operations are much the same as those used by management in production departments. But first comes a clear picture of what elements are involved. Hence our 3-D presentation of these elements, together with some typical groupings, pp 98-101.

Be sure to discuss this business of organization with your power-service manager. He knows the weak links as well as the strong points of the present setup. Mutual confidence and a frank exchange of ideas is absolutely essential.

Start with an analysis of the elements diagrammed on pp 98-99. Chances are your setup represents a good chunk, but not all, of the "cube." Decide which elements can best be grouped together, keeping in mind available personnel. Don't make the pattern any more complex than necessary. Information flows faster and control is more effective if channels are direct.

A word of caution: Don't count on using a scheme that worked well in a similar company or industry. No two cases are alike. Best organization pattern is tailor-made for your plant.

Finally, be prepared to change the plan as your plant grows, as the situation changes.

3 Give your power-service managers authority they need

This goes hand in hand with a good organization pattern. You'll have to clearly define the limits of authority as well as responsibility so functions are neither left in a vacuum nor caught in the crossfire of conflicting authority.

As a rule, power-service supervisors should be on a par with production managers. This promotes a close working relationship between the two groups — a must situation in today's complex industrial and institutional operations.

these familiar managerial principles

Set up . . . and maintain . . . channels of communication

4

To properly *serve* production operations, power-service managers must have full information regarding energy needs, and particularly upcoming changes in those needs. Equally important, production heads must know what they can expect from the power-service system and how to use the plant utilities with maximum effectiveness.

This 2-way flow of information can't be left to chance. It must be made automatic, either by regular reports or by scheduled meetings. Close cooperation between the services and production will save dollars and grief all along the line.

In any system, always remember the human element

5

The success of any power-service system rests on people. Here are some points to consider beyond the normal personnel routines: (1) Recognition — have you shown the power-service staff you appreciate a job well done? (2) Education — do you encourage formal or informal training activities to increase job understanding, prepare for advancement? Many organizations subsidize part-time attendance at technical schools. (3) Performance — have you given your power-service men a yardstick for gaging it? Such yardsticks stimulate performance consciousness.

Ask for . . . and use . . . regular performance reports

6

In many instances, such reports are the most effective means of exercising executive control. A concise statistical statement, backed by explanation where needed, will usually serve as a sound basis for managerial action.

A typical report might include: total use of each service for the period, unit and total costs, analysis of departures from "normal" usages or costs, recommendations for appropriate action. Use an easy-to-read standard form to save time both in preparation and reading. Keep it simple — don't ask for more data than actually needed.

Cost-account your power services . . . and do it right

7

Distributing service costs among production departments is an essential step in controlling consumption, eliminating waste. It can be done in several ways; for most services it's a simple job.

But where steam and electricity are generated jointly, the costing method used can materially influence a wide variety of production and investment decisions. This is no place for detailed analysis, nor is that an executive's responsibility. It *is* up to you to see that engineers and accountants work together to devise an equitable costing system, have the means to apply it.

Provide for maintenance and replacement of equipment

8

Your power-service equipment represents a large investment. It is only good sense to prolong its life, and insure reliable operation, by making sure equipment is properly maintained. This means a good plan, backed by the funds to run it.

In spite of the best maintenance, equipment must eventually be replaced. Provision for such replacement is an integral part of power-service cost and hence a part of the cost of your goods or services. Unless this is allowed for in costing, price of product or service will be out of line. Perhaps even more important, relations between various plant operations are distorted. Completely unsound operating decisions can result.

. . . for investment opportunities, see next page ▶

executive leadership . . . follow through

When it comes to putting capital into production machinery, you apply a simple test: Will the investment pay out in a reasonable period? But for some reason the question never seems so simple when power-service improvements are at stake.

Yet a profit dollar gained in the operation of the power services is just as good as one gained in direct production operations — and it's often easier to get.

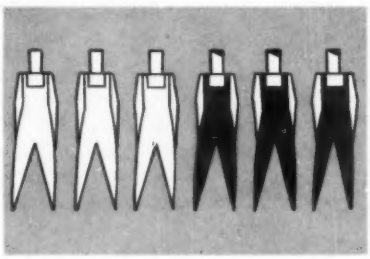
If you'll look at power-service investments as you would any others, you'll find plenty of places where modernization or improvements will pay out in less than five years. As a guide . . .

check these likely profit possibilities

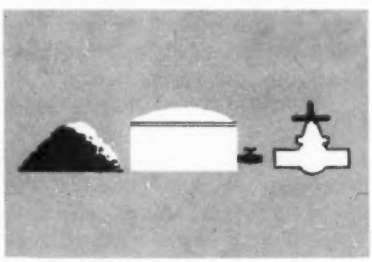
Extensive changes in your power service setup can involve major capital expenditures. Such changes are inevitable: Future shifts in products or services will make different demands on the system, new and improved equipment will prove economically attractive, some old units will reach the end of the trail.

Nothing is more expensive than a "too little, too late" approach. To insure a smooth step-by-step improvement program, and maximum value from dollars invested, ask your power-service managers for long-range plans. And give them the data they need to fit their plans into organization-wide programs for expansion.

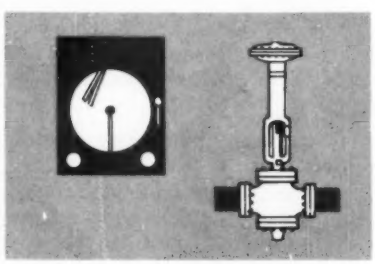
labor cost . . .



fuel expense . . .



service usage . . .



with wise investment for future profits

...reduce it by mechanization and automatic control

In today's economy, manpower is just about the most expensive item you buy. So listen hard when your power-service manager offers labor-saving ideas.

Is your plant only a step or two beyond wheelbarrow methods of handling coal and ash? Then there are real profit possibilities in mechanized handling. Today's equipment, automatically controlled and interlocked, reduces the human element to a minimum.

Look to automatic controls of all kinds, particularly combustion controls, for other quick returns. In one plant recently, making a small boiler room automatic saved $17,000 per year, mostly in labor. Payout on the modest cost ($1600) was less than six weeks.

Poor plant layouts, dating back to days when labor was cheap, prove costly today. You may not be able to put off rebuilding when you see what modern equipment can do in a manpower-saving layout.

Finally, don't forget that manpower is the prime expense element in maintenance. Modern equipment is designed to reduce maintenance to a minimum.

...modern equipment will cut both unit and total cost

Fuel is a major cost factor in steam generation and, of course, in all the other power services, such as electricity, that use steam as a raw material. Today's fuel prices stand at high levels, look to go higher.

Up-to-date fuel-burning equipment is more efficient — it gets more heat units out of a ton of coal, a gallon of fuel oil or a cubic foot of gas. But it may offer even more important savings in greater fuel flexibility, particularly where coal is the fuel.

Without going into technical details, old furnaces and fuel burners usually operate well on high-grade coals only. Modern units handle a wide range, permit buying the coal that shows lowest over-all cost per heat unit, in your plant. What's more, many modern units offer ready convertibility from one fuel to another — an important profit factor in areas where fuel prices are competitive, or may become so.

So when it comes to fuel expense, new equipment shows a 2-way profit — makes it possible to buy fuel at lower unit cost, and slashes the total consumed

...control it, meter it, charge it by departments

If you discovered 25% of your finished products were being thrown away, you'd put a stop to it, but quick. Yet something very like that goes on in most organizations all the time. Power services—finished products from complex technical operations—are used, on the average, less than 75% effectively.

For example, there's a colossus of heavy industry where a modern boiler house supplies steam to scores of buildings — and there's not a single thermostat. Used and unused spaces are heated alike, temperature is regulated by opening windows. A trifling investment in controls would save at least $100,000 per year.

To avoid waste like this in your plant, make sure that your power-service men get the controls they need to take the human element out of service usage, and that they get enough meters to tell how much of each goes to each user. Finally, charge production departments with what they consume. Then they'll have a dollar incentive for working with the power-service managers to make best use of these energy sources.

...turn page for case studies in profits

executive leadership . . . maintain your

What happens when sound managerial principles and wise power-service investment policies are put to work? Examples of the resulting benefits are legion and actual cases could be cited endlessly. They have been so cited in case-study articles appearing over the years in POWER's pages.

Here we present four typical cases, selected because they show, in various ways, the application of the principles we've discussed on the preceding pages. The cases are real, *and so are the profits.*

The Case of the Muddled Manager

What shapes up as a sound power-service management pattern today may not be able to cope with tomorrow's changed situations. That's what happened in an East Coast paper mill where power-service operating and fixed costs now run more than $1,000,000 annually.

Back in 1945, when this story starts, these costs were running at only half that level. On this operating scale, one man—the engineering services manager—headed not only the power services, but other plant services as well. And he did all right until the mill's business began to expand rapidly.

With a lot bigger job on his hands, this engineering service manager had sole responsibility not only for major decisions but a host of minor ones to boot. When dollar efficiency dropped off, it was at first blamed on the inflationary times.

But when price competition got tough, top management took a hard look at the organization structure. They quickly freed the engineering services manager of time-consuming responsibilities for miscellaneous services. With full time and authority for the power services, he developed a sorely needed preventive maintenance program, cut operating costs by 12%, proved the new pattern fitted the changed situation. Does your setup need a fresh look?

The Case of the Cut-Rate Kwhr

Not all power-service profits come from more efficient generation, distribution or application—solid savings are also made by intelligent buying of services like electricity.

To see what can be done in this direction, when top-management has some power-service know-how, look at what happened in a large chemical company. In this plant, some electricity was self-generated, but most was purchased. At an average rate of 1.1¢ per kwhr, the power bill ran about $50,000 per month.

With sales climbing, management decided to increase process facilities 25%, requested a detailed electrical study. This showed that about half of the bigger electrical needs could be generated as a byproduct of needed steam. Investment required could be written off in three years, leaving an annual profit of about $100,000 thereafter.

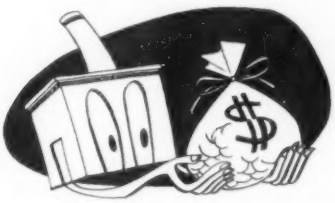
This looked good, but a well-posted v-p asked power-service heads to see what the local power company could do. It couldn't meet the price of self-generated power, but higher consumption and better load made possible a

new contract at more favorable rates. The chemical company put less than a third of the investment originally proposed into additional boiler capacity, realized a yearly saving of $70,000 on electricity. Are you getting the best buy on services you purchase?

profits by continuing sound management

The Case of the Big Payoff

Getting ready for tougher competition, management of an auto company engaged consulting engineers to put their power services under the microscope. The modernization plan developed led to savings of well over $400,000 per year. Story below tells how they did it.



When the study began, old boilers in a manpower-costly layout supplied steam for heating and process. Part of plant's electrical needs was generated as a byproduct of this steam. Age of the boilers dictated some rehabilitation in any case; the question was what would be most profitable procedure.

Consultants developed a series of alternative plans, ranging from generation of steam only, through various combinations involving electrical generation also. Plan selected replaced 10 old boilers with three modern units of greater capacity, operating at higher pressure. This permitted installation of a "topping" turbine, for additional generation.

Fewer boiler units, in a better layout, reduced operating staff substantially. Modern equipment burned less fuel and permitted using less-expensive coal. More savings came from generating a larger proportion of electrical needs as a byproduct of steam.

In the new layout, space was made for consolidating two air-compressor rooms into one, for further savings in operating labor. Rebuilding the primary electrical system eliminated hazards, increased flexibility.

Here, then, is a typical example of profitable modernization. For an investment that will be paid off in about five years, this company obtained a modern, efficient plant that will give reliable, economical service for years to come. What are the possibilities in your plant?

The Case of the Costly Air

Eliminating waste and misuse of power services sounds like a niggling business, hardly worth executive attention. To see how wrong this can be, take a look at the case of a heavy-industry operation where management, consultants and power-service men teamed up on the job. In compressed air alone, their efforts saved $1000 per day — all for an expenditure of less than $100,000, most of it in labor.

When a cost study was made, biggest single loss proved to result from low air pressure at pneumatic tools. This cut work output by an average of one-third. At a cost of only $10,000, mostly in labor, correct hoses and fittings were installed to restore pressure needed for full output. Resulting saving in expensive man-hours was worth $138,000 a year.

A long, hard look at operating manpower actually needed for generation of compressed air turned up a saving of close to $70,000 per year. And they found that patrolmen in areas covered by air-actuated sprinklers could be dispensed with, to the tune of $40,000.

Checks of air leakage showed almost half compressor capacity was being used just to supply leaks. Production workers' negligence was wasting additional air. These items, plus a substantial amount of plain misuse of compressed air, were costing over $70,000 per year.

A further saving of some $25,000 annually came from improved maintenance, testing and lubrication of pneumatic tools.

Costs like these, on larger or smaller scales, are being incurred in all the power services, in industries and institutions where management fails to give its interest and support to power-service supervisors. In cases like this, do you back your people to the hilt?

...do you need outside help?

outside help . . . why, when, how to use it

In this age of specialization it is often uneconomical for a company to permanently employ all skills needed to design, construct, operate and maintain all the power services. Thus, one of the big needs for outside help. The wide variety of outside specialists available range from large multi-service firms, to individual consultants. And they'll handle jobs from the complete design and construction of a large plant, through plant surveys and rate studies, to trouble-shooting a single operation. Many outside organizations will also supervise new plant startups to iron out kinks.

While large enterprises use such services extensively, many small companies feel either that they can't afford the cost, or that most professional service organizations won't do business with them. Actually, both large and small firms can profit greatly from the broad experience of these outside specialists. Let's see why, when and how they can serve *you*.

why . . .

- Being close to the job can be a peril as well as an advantage. It often happens that the man who lives with the day-to-day routine is unable to see the forest for the trees. Thus, he may miss out on the practical solution to a tough problem. In such cases, the fresh viewpoint of a professional consultant is likely to suggest the common-sense course.

- "Experience is the best teacher." But—it runs a very costly school. By consulting outside help you get the benefit of their wide experience on jobs similar to yours, where they've had an opportunity to develop tried-and-tested methods.

- Because professional service firms don't sell equipment, they have no ax to grind. They are free to select from the products of many manufacturers, based on objective comparisons. Result is a technically sound and economical design suited to the needs of the client.

- The outside specialist-engineer can check and supplement the thinking of your own engineers. This might consist of nothing more than a single consultation, but could easily save thousands of dollars. Fee for such service is relatively modest.

when . . .

- If you're considering power-service expansion or significant changes in system, the engineer-constructor can do large amounts of engineering, drafting and building in a short time. Most projects require a design and construction schedule that yields operating benefits at the earliest possible moment. The qualified outside firm assigns a large enough staff to complete the job within the agreed time.

- The professional-service engineer can help when you suspect that certain operations might be done more efficiently. This is especially important when competition is close.

- There is need for an impartial outside agency to conduct acceptance tests on important new equipment. Firms fitted for such work can also test old equipment to determine whether replacement would pay.

- Call in consulting organizations to avoid difficulties before they arise. It's easier to stay out of trouble than to try to find ways to cure it. The old story of the Chinese doctor being paid only when the patient is healthy can well be applied here.

how . . .

- Don't choose outside help on a price basis alone. In the final analysis, the cheapest can be the most expensive. The "high-priced" engineer, if he is the best, is more apt to produce results you seek.

- Ask for a record of past performance. Reputable engineers will be glad you've given them a chance to prove their competence to you.

- Give the engineers all information pertinent to the problem. It will be well worth your staff's time to provide them with a summary of the situation as they see it. Withholding key facts can only lead the outside specialist to false conclusions.

- Having chosen good engineering advisors, give them a loose rein. They'll be free to give you the best possible job. Their reputation depends on it.

. . . and now let's summarize

THE ANSWER COMES IN DOLLARS

Summing up this engineers' report to executives . . .

- The power services of American industry and institutions are a neglected opportunity for important profits.
- The typical plant can save as much as one cent in four, now spent for the power services in their entire range from generation to productive application.
- For a case where four cents of the sales dollar goes to the power services and ten cents to net income before taxes, cutting one cent from the services will add 10% to net.
- To put it another way, $100,000 earned in the power services is worth an added million of income.
- These service profits may be direct or indirect. Direct profits come from lowering the unit cost of the services and from cutting waste in their distribution and use.
- Indirect profits are earned by maintaining high service dependability and quality, and by proper use of the services to get maximum production and high product quality.
- To achieve these requirements the first essential is a competent power-service organization, made effective by executive understanding, ample delegated authority and recognition commensurate with accomplishment.
- In general, top management should . . .

  . . . have a good understanding of the power services and organize them along sound lines.

  . . . cost the power services. But be sure the system provides incentive for real savings. Ask for, and use, regular performance reports.

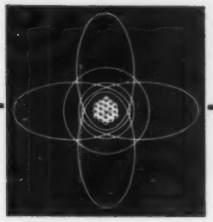
  . . . take a good look at its present services setup. Find out where power-service operations can be tightened up by eliminating wasteful practices.

  . . . apply the same yardstick to power-service expenditures that is used for new production equipment — an adequate return on the investment.

  . . . investigate possibilities for extra-profitable power-service investments. Often the purchase of a small but key piece of equipment yields big savings.

  . . . encourage power-service managers to prepare a long-range improvement plan for the services — one that ties in with future plans of the entire organization.

a **Power** special report



Nuclear notes

By B G A SKROTZKI, *Associate Editor*

Atomic Energy Commission has approved the proposal of the Bethlehem Steel Co's Shipbuilding Division to study application of nuclear power to commercial ship propulsion. This second study in ship propulsion brings total of atomic studies for power and byproducts to 17. Bethlehem also proposes to explore developing package reactor for stationary electric plants and for water distillation.

Uranium mining is in the "gold rush period" where the public gambles in grub-staking the prospector, says A G Erpf, investment broker. A small percentage will strike it rich and perhaps a large ore reserve will be proved. But, cautions Erpf, as long as the public gambles only what it can afford to lose, financial damage won't be great.

Industrial participation in atomic projects is more widespread than we generally appreciate. There are about 8000 sub-assemblies in the submarine *Nautilus* fabricated by 3500 different manufacturers.

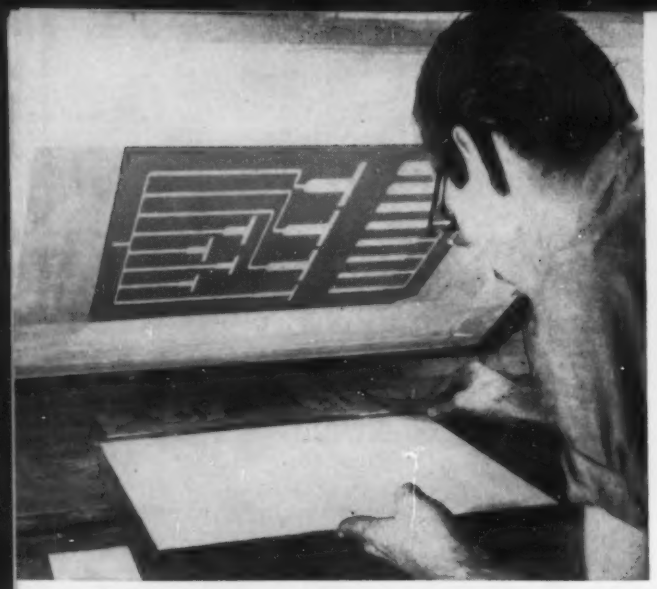
South African gold mines, also producing uranium, have operating lives estimated as 30 to 40 years, says R L Faulkner of AEC. Some reefs, too low-grade in gold to be worked, can be mined economically when taking uranium byproduct into account. South Africa will be a leading producer of uranium for many decades.

Thumbnail estimates show that about 600 tons of uranium inventory are needed per million kw electrical capacity. This includes reactor charge plus uranium being recovered by reprocessing. Assuming 2% "burnup" of uranium will be practical (higher efficiencies are probable in future), it seems that about 50 tons of uranium metal annually will be needed per million kw capacity.

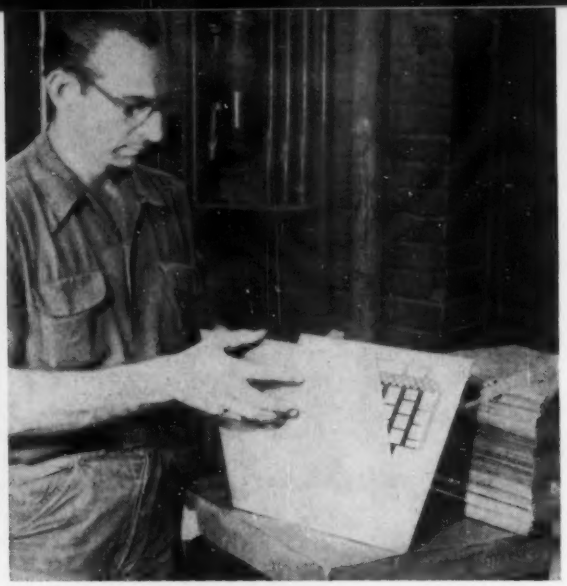
Plant factors of nuclear generating stations apparently cannot be as high as base-loaded steam plants. Shutdown time to replace solid fuel elements in reactors may hold down plant factors to a high of 80 to 85%. Long life for fuel elements requires shifting them several times while in the reactor.

"Ghost town," we thought while visiting Palos Park (near Chicago) predecessor of the Argonne National Laboratory. Here stands the first operating reactor, initially erected in Stagg Field of the University of Chicago and run on Dec 2, 1942. It was moved to present site in early 1943 and re-started on March 20, 1943. On May 15, 1944 a heavy-water-moderated reactor joined the pioneer in atomic research. Both reactors were shut down permanently on May 15, 1954 and operations moved to Argonne. Vacant barracks-type offices, laboratories, cafeteria and service buildings give mute testimony of a rocketing technology. We hope steps will be taken to preserve the remnants of the first pile behind its massive concrete shield as a monument to the dawning of the atomic era.

Zooming atomic developments seem to move faster than that when looking over the record. The neutron was discovered in 1932, fission in 1939 and the chain reaction in 1942. In addition to the atomic and H-bombs we now have power-producing reactors, experimental to be sure, but with firm overtones of practicality. For the future there is Moon Metals and Minerals Incorporated for mining the earth's moon. How? By shooting space rockets fitted with atomic warheads to the moon. Exploding beneath its surface, showers of minerals would be aimed toward the earth to land on desert areas where they would be recovered rather easily by earth-bound men.



1 Silk screen acting as stencil is laid on aluminum sheet. Stop-weld material is squeegeed on plate through screen



2 Two aluminum sheets placed face to face form metal "sandwich" with stop-weld material on one plate between them

Roll-bonding of metal slashes cost of developing new heat-transfer elements

Future heat exchangers are likely to have a new look because of the design and fabricating ease offered by this newly revealed production process. While *Power* readers usually have only minor interest in methods of manufacturing power equipment, the editors feel they will want to know about this one

► RECENTLY, Olin Mathieson Chemical Corporation announced a process that produces any pattern of tubing wanted in a single homogeneous sheet of metal. Using the old art of roll-bonding two sheets of metal, supplemented with an important new "kink," results in amazing reductions in tooling costs.

While only in the pilot-plant stage, the process has been applied to commercial production of freezing boxes for domestic refrigerators. Tooling costs for the original method of brazing tubes to aluminum sheets totaled about $50,000. The comparable cost for the new roll-bonding method falls to only $50! Retooling time drops from six months to one week. Other benefits include lower production costs and heat-transfer rate increases of more than 25%.

Process. Photos show essential steps in the process. To produce a tubed plate, as in Fig. 8, do this: (1) Cut two flat pieces of metal to size, and clean. (2) Apply desired pattern of tubing to one metal sheet by silk-screen process. The "paint" is a *stop-weld* material of secret composition. (3) Place metal sheets face to face with pattern between and spot-weld to hold in position. (4) Heat and roll the plates to form complete bond between them. Where stop-weld material has been laid prevents bonding. (5) Cold-roll new single sheet to proper length and thickness. Final length in Fig. 8 is over four times original plate length. Anneal cold-rolled sheet.

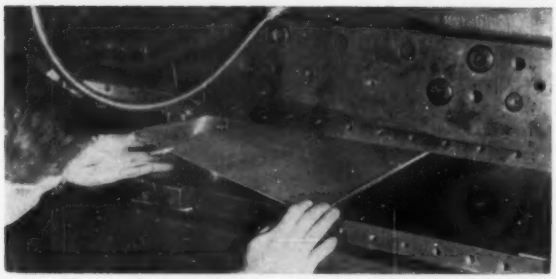
(6) Trim sheet to bare lead-in end of stop-weld pattern. (7) Insert needle, similar to that for inflating football, in bared end. (8) Place sheet between two separated heavy platens in hydraulic press. Inject 3000-psi hydraulic fluid into needle to inflate passages where stop-weld was applied. (9) Flush out passages (tubes) to remove stop-weld, and dry. (10) Trim to size.

Applications. These types of units will find many uses in air conditioning, space heating, air heaters, extended-surface heat exchangers, radiators, etc. Solar heating can use panels of this type for roofing to receive heat, and as walls, floors and ceilings to radiate heat in rooms.

Metals that have been used include aluminum and alloyed aluminum, copper, zinc, carbon steel and stainless steel. Tubes are pressure tested in making.

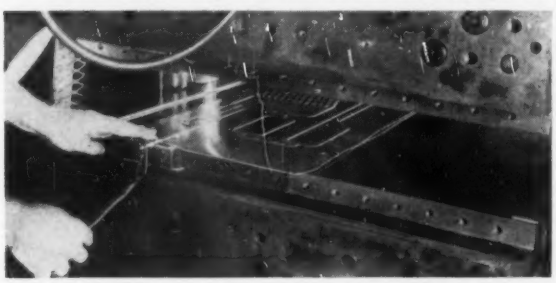
3 After being spot-welded to hold them together, aluminum sandwiches enter furnace before hot rolling, which bonds them together except at stop-weld lines

4 After hot-rolling, single-bonded sheet is cold-rolled to final desired size

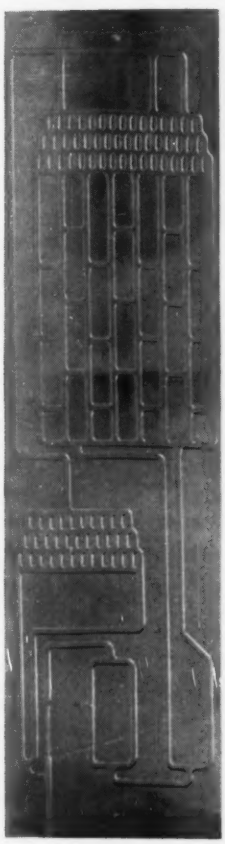


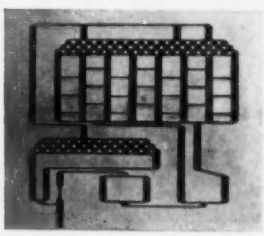
5 With needle inserted at pattern lead-in, the cold-rolled sheet is placed between two platens of hydraulic press

6 With sheet held between separated platens, 3000-psi fluid expands sheet along the lines of the stop-weld pattern



7 Bonded aluminum sheet, with passages expanded along lines of stop-weld pattern, is ready for flushing out and drying

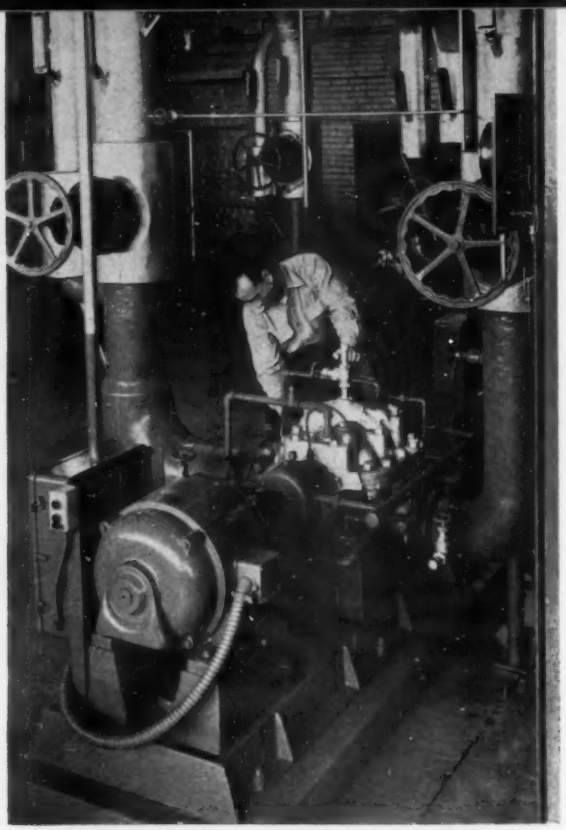




9 Micrograph shows complete welding of metal in bonded section, separation at stop-weld

8 Finished sheet, *left*, is over four times as long as first plate, top *right*, with stop-weld pattern printed on it

New hydraulic standards will give the latest industrial-pump data



PUMPS, vital components of almost every industrial, service and institutional operation, are the subject of new standards

► The Hydraulic Institute is a trade association comprising the principal manufacturers of centrifugal and displacement pumps in the U.S. Organized in 1917, it cooperates with a large number of organizations with which the pump industry has common problems.

Standards. To be of greater service to engineers, purchasers and users of pumps, as well as to its own members, the Institute publishes pertinent technical and engineering data on pumps in its *Standards*.

A standard of the Hydraulic Institute defines a product, material, process or procedure with reference to one or more of the following: Nomenclature, composition, construction, dimensions, tolerances, safety, operating characteristics, performance, quality, rating, testing, and service for which designed. Existence or adoption of a *Standard* by the Hydraulic Institute does not in any respect preclude a member or nonmember from manufacturing or selling products not conforming to it.

New standards. Tenth edition of *Standards of the Hydraulic Institute*, to be published in January 1955, is an extensive overhauling of all previous editions. Aside from the technical material, which has been added and brought up to date, this edition is completely rearranged and has a detailed index for locating specific material. A revision service will assure every holder of a copy of *Standards* of up-to-date information for an estimated period of four years from the date of publication.

Outstanding among the many features of this edition is a new section on nomenclature for centrifugal pumps. Definitions of component parts are supplemented by sectional drawings, designed to show the parts in their proper relationship to the entire assembly.

Standards classify centrifugal pumps in ten types: single-stage, multi-stage, volute, circular-casing, diffuser, horizontal, vertical (dry-pit), vertical (submerged), single-suction and double-suction types.

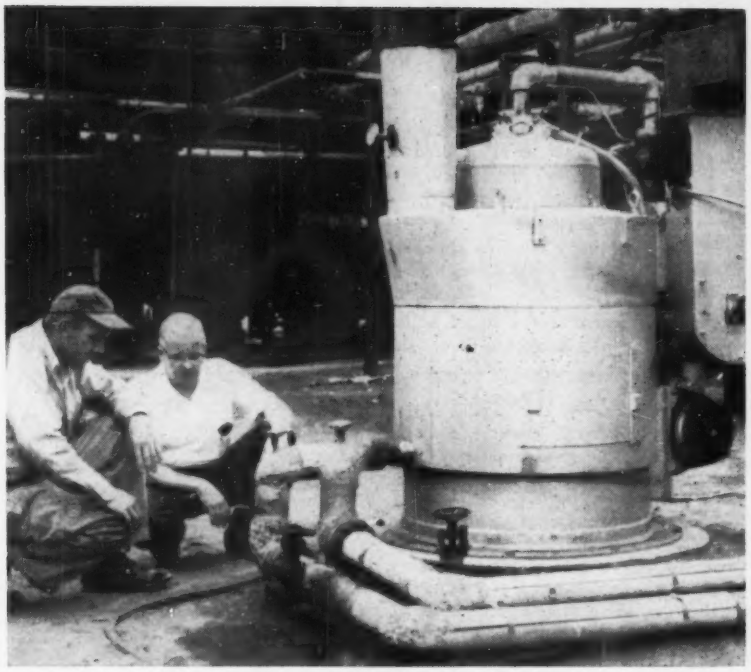
The section on rotary pumps has been rewritten for clarification and greater accuracy. Power-pump nomenclature and component parts are now included in the reciprocating-pump section.

Pipe friction. Of particular importance to designers, users and manufacturers is the Data Section in which equivalent lengths for valves and fittings are tabulated. These data, for pipes ranging from ¼ to 24 in. diameter, represent the results of a large amount of painstaking experimental work and lengthy calculations.

The revised Data Section also contains condensed pipe-friction tables based on the new *Pipe Friction Manual* published by the Institute in November 1954. These tables are an innovation developed for those individuals who have no need for the more detailed and complex data in the *Manual*.

Materials. The Data Section also contains a completely revised and highly augmented section on materials specifications for pumps used in almost every type of conceivable application from water to highly corrosive chemicals.

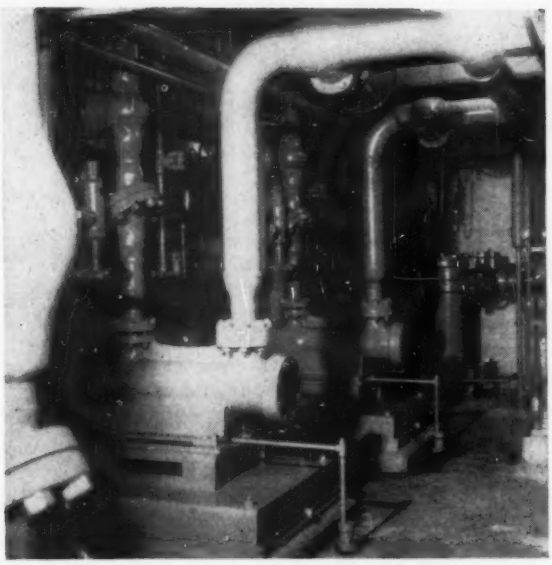
Always of value to pump manufacturers, the new *Standards* should go a long way toward helping purchasers obtain pumps best suited for their particular job conditions. They provide a link between plant designer and pump manufacturer that leads to better specifications, more accurate orders and satisfactory operation. Pump operators can also benefit from their use because they contain many valuable tips on correct installation, operation and maintenance. Representing, as they do, the pooled know-how of a large cross section of the pumping industry, *Standards* are of great value to everyone concerned.



STEEL COILS in this Vapor-Clarkson hot-oil heater receive 15 gpm from crude still at 630 F, discharge it at 780 F. Operation increases output by about $100 per day

THERMOMETER, *left,* shows 630-F inlet. *Right:* outlet temperature of oil, 780 F

Two smart designs: one cuts overhaul costs, the other solves pump problem



FUEL-OIL PUMPS have motor and turbine on common baseplate. Turbine automatically takes pumping load if a failure occurs

Design No. 1, *photos above.* This Vapor-Clarkson unit, set up as a hot-oil heater in a refinery, accounts for $100 per day greater output from a crude still. Similar to the steam generators this firm manufactures for many railroads, the unit is but slightly larger than a home refrigerator, can be truck-mounted for easy transportation.

A Midwest laundry makes good use of one of these steam generators during routine overhauls of its stationary boilers. When a unit needs overhauling, the truck-mounted generator is driven to the plant and hooked into the process line. While normal production continues without interruption, the day personnel, who are familiar with plant units, can overhaul the boilers. Saving in overtime alone goes a long way toward writing off the generator cost.

Design No. 2, *photo left.* Standby fuel-oil supply, often a steam-plant problem, is neatly solved in West Coast muncipal job. DeLaval-Imo dual drive pump mounts on one bedplate with 50-hp single-speed motor and a turbine, supplied 250-psi steam. Unit pinch-hits if its twin fails.

Motor on common shaft with pump usually drives turbine. When pump speed falls 150 rpm below normal motor speed (1150 rpm) turbine governor opens throttle valve to keep pump speed 1000 rpm, with uninterrupted service.

Standby pump is kept warm at all times by a bypass hookup. In summer, when gas is fired, both pumps are idled by oil discharged from a small Imo motor-driven 1.5-hp pump.

Name & formula	General location	Causes of formation	Preventive measures
Acmite $Na_2O \cdot Fe_2O_3 \cdot 4SiO_2$	Boiler Superheater Turbine	Reaction between silica, iron oxides and caustic in overheated tubes Carryover of sodium silicate and reaction with iron oxides	5, 8, 9
Analcite $Na_2O \cdot Al_2O_3 \cdot 4SiO_2 \cdot 2H_2O$	Boiler	Reaction between alumina, silica and alkalinity in areas of high temperature	1, 9, 13
Anhydrite $CaSO_4$	Boiler	Under treatment of boiler water containing high hardness and sulfates	3, 7, 9
Aragonite $\mathcal{A}$ $CaCO_3$	Lime softener Feedwater heater Feed pump Feed line Heating boiler Cooling system	Thermal decomposition of calcium bicarbonate at relatively low temperatures Inadequate sludge conditioning	2, 4, 6, 7
Brucite $Mg(OH)_2$	Lime softener Feedwater heater Feed pump Feed line Economizer Boiler	Precipitation of magnesium at high pH Inadequate sludge conditioning Ineffective sludge removal Feeding caustic to feed line	1, 2, 4, 7, 10
Burkeite $Na_2CO_3 \cdot 2Na_2SO_4$	Boiler tube Superheater Turbine	Evaporation to partial dryness in water-starved tube Carryover	1, 8, 9
Calcite β $CaCO_3$	Lime softener Feedwater heater Feed pump Feed line Economizer Boiler Cooling system	Thermal decomposition of calcium bicarbonate Inadequate sludge conditioning Ineffective sludge removal	1, 2, 4, 6, 7

Scale formation in steam-water cycles:

Analyses of steam-water cycle deposits are often given in terms of mineral names. To help the operator, this table links the name of the mineral to its chemical formula

By H E EIGNER
Water-Conditioning Section, Allis-Chalmers Mfg Company

► THIS TABLE is meant for general information only, and actual application must include a complete study of all the factors in a particular cycle. Numbers listed in the table under *Preventive measures* refer to the following points.

1. Blowdown. Use continuous or intermittent blowdown at proper time to remove conditioned sludge from right boiler section, control dissolved solids in boiler water or maintain concentration of one constituent at a certain level.

2. Sludge conditioning. Make sludge fluid and nonadhesive by using coagulants or dispersives designed for the particular conditions of temperature and pressure involved.

3. Internal chemical treatment. Precipitate hardness as carbonate or phosphate by chemical treatment.

4. Surface-active agents. Use complex phosphates and dispersives to inhibit precipitation of hardness in the feedwater lines.

5. Corrosion. Deaerate feedwater properly; chemically scavenge oxygen residuals; maintain higher pH in feed lines, condensate lines and boiler; reduce available CO_2 in makeup; prevent overheating; form protective films in system.

Name & formula	General location	Causes of formation	Preventive measures
Copper Cu	Boiler	Precipitation of copper dissolved from other parts of system	5
Cristobalite SiO_2	Turbine	Carryover and selective deposition of silica	8, 11
Ferrous oxide FeO	Boiler Superheater	High-temperature steam-iron reaction (over 1058 F)	9
Goethite $\alpha Fe_2O_3 \cdot H_2O$	Raw-water line Condensate line Cooling system	Corrosion of iron in water with high oxygen content	5
Halite NaCl	Superheater Turbine	Carryover	1, 8
Hematite Fe_2O_3	Location unrestricted	Moderate-temperature corrosion of iron by water containing oxygen	5
Hydroxyapatite $Ca_{10}(OH)_2(PO_4)_6$	Phosphate softener Feedwater heater Feed pump Feed line Economizer Boiler Cooling system	Precipitation of calcium with phosphate Inadequate sludge conditioning Ineffective sludge removal	1, 2, 4, 6, 7
Lepidocrocite $\gamma Fe_2O_3 \cdot H_2O$	Raw-water line Condensate line Cooling system	Corrosion of iron in water with high oxygen content	5
Magnetite Fe_3O_4	Location unrestricted	Partial oxidation of iron Oxygen concentration cell corrosion	5, 9
Magnesium hydroxyphosphate $Mg(OH)_2 \cdot Mg_3(PO_4)_2$	Boiler	Precipitation of magnesium with phosphate Excessive phosphate residual Inadequate sludge conditioning	2, 10, 12

Table continued on page 120

Its location, cause and cure

6. Feedwater alkalinity. Feed all alkaline materials direct to boiler.

7. Feedwater hardness. Reduce makeup to lowest practical level, control raw-water contamination of condensate, provide external softening equipment to reduce makeup water hardness.

8. Carryover. Control solids by blowdown to prevent foaming, maintain design water level, use and maintain steam separators to control physical carryover, balance load changes that cause surging and priming, reduce constituent of boiler water that carries over, prevent entry of oil into boiler, use antifoam agents.

9. Overheating. Use blowdown and sludge conditioners to control baked-on sludges, eliminate causes of scale, repair baffles that direct hot gas into wrong section of boiler, eliminate flame impingement, prevent operation at excessively high loads, eliminate oil films that restrict heat transfer, blowdown waterwalls under light loads only, modify sudden shutdown and startup procedures.

10. Boiler-water magnesium content. Operate external softening equipment in correct pH range to precipitate magnesium. Remove completely by evaporation or ion exchange.

11. Boiler-water silica content. Blow down boiler to maintain silica content at desired level, evaporate or demineralize makeup for silica removal.

12. Boiler-water phosphate content. Control addition of phosphate to prevent excess above the recommended amount in the boiler water.

13. Boiler-water aluminum content. Use aluminum free source of makeup water, reduce feedwater aluminum by operating filtration plants and oil-removal filters at pH range in which aluminum is insoluble. Control the amount of coagulant that is used in the feed system.

SCALE FORMATION continued

Name & formula	General location	Causes of formation	Preventive measures
Quartz SiO_2	Boiler Turbine Cooling system	Precipitation of silica Carryover Sand in system (cooling system)	1, 8, 9, 11
Serpentine $3MgO \cdot 2SiO_2 \cdot 2H_2O$	Lime softener Boiler	Recrystallization of silica adsorbed by magnesium hydroxide Inadequate sludge conditioning Ineffective sludge removal	1, 2, 10, 11
Siderite $FeCO_3$	Steam line Condensate line Cooling system	Reaction between iron and excessive amounts of carbon dioxide	5
Silica (amorphous) SiO_2	Feed line Boiler Superheater Turbine	Adsorption of soluble silica by oxides and hydroxides Carryover	1, 8, 11
Sodium metasilicate Na_2SiO_3	Turbine high-temperature section	Carryover of silica and caustic	8, 11
Sodium disilicate $\beta\ Na_2Si_2O_5$	Turbine	Carryover of silica and caustic	8, 11
Thenardite Na_2SO_4V	Boiler tube Superheater Turbine	Evaporation to partial dryness in water-starved tubes Carryover	1, 8, 9
Xonotlite $5CaO \cdot 5SiO_2 \cdot H_2O$	Boiler	Reaction between calcium and silica at low alkalinity	3

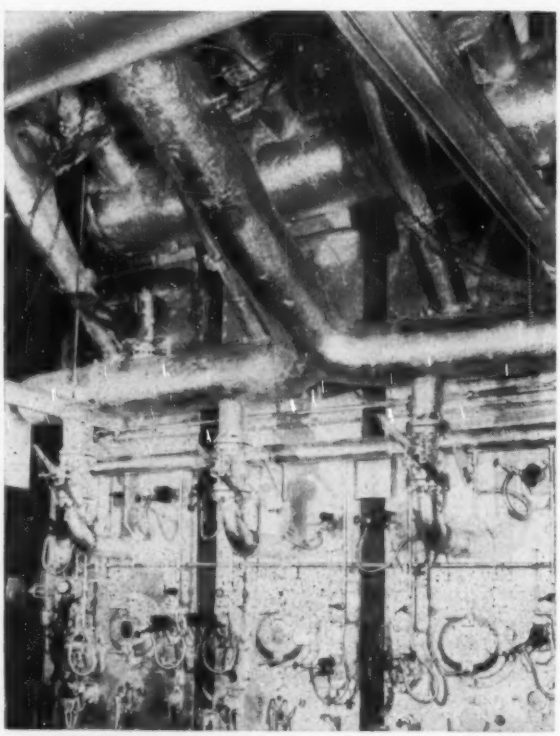
Insulating a screech helps keep operators happy

► MINERAL WOOL not only insulates heat flow, it can also insulate against noise. The Long Island Lighting Company used it this way at its Glenwood Landing power station.

Fast-flowing natural gas through burner supply lines produced a piercing shriek. When these lines were insulated with mineral wool, the noise was cut to such an extent that it is now inaudible above normal plant noises. The reduced noise improved comfort and efficiency of operating personnel considerably.

Illustration shows insulated T-shaped pipe above the burners of Glenwood's No. 4 boiler. The only purpose of insulation here is to cut noise. Smaller pipes connect large gas line to burners.

Insulation on T-shaped pipe section consists of a single layer of 1½-in.-thick mineral-wool felts and two ½-in.-thick layers of insulating cement. Felts were wrapped around gas line and tightly secured with 20-gage wires circling insulation on 8-in. centers. Cement went on wire mesh, wired over felts. A coat of asphalt mastic and two coats of aluminum paint finished the job.



MINERAL-WOOL INSULATION, covering burner gas-supply line, reduces to soft murmur a piercing shriek due to the gas flow

Power's DATA SHEET

No. 270

Electrical utility fuel costs – 1953

Region	Average fuel costs, ¢ per million Btu: All fuels	Coal[a]	Oil[b]	Gas[c]
United States	25.2	27.1	32.4	16.7
NEW ENGLAND	35.5	36.3[d]	34.7	34.0
Maine	36.9	—	36.9	—
New Hampshire	34.6	44.7	34.2	—
Vermont	60.7	58.6	60.7	—
Massachusetts	34.8	36.9[d]	33.5	34.0
Rhode Island	34.3	34.3[d]	35.2	—
Connecticut	36.5	36.4	36.6	—
MIDDLE ATLANTIC	30.1	29.6	33.4	29.4
New York	34.1	34.5	34.3	30.1
New Jersey	32.5	33.8	32.3	28.5
Pennsylvania	25.2	24.8	34.1	29.1
EAST NORTH CENTRAL	25.6	26.0	65.7	20.2
Ohio	23.0	22.9	60.2	29.9
Indiana	23.1	22.9	77.0	30.0
Illinois	24.7	25.9	57.0	18.7
Michigan	30.8	30.8	74.3	28.4
Wisconsin	32.0	31.9	81.1	38.1
WEST NORTH CENTRAL	24.9	28.4	48.3	20.6
Minnesota	30.2	33.2	67.6	26.4
Iowa	28.5	30.3	70.8	24.9
Missouri	21.9	23.6	39.5	16.6
North Dakota	28.3	28.1[e]	94.5	31.2
South Dakota	34.5	37.0[e]	81.6	28.7
Nebraska	26.7	31.8	80.6	23.6
Kansas	18.4	24.5	32.7	16.3
SOUTH ATLANTIC	27.3	27.2	32.4	21.4
Del, Md, DC	32.1	32.0	54.9	—
Virginia	28.5	28.2	36.6	26.3
West Virginia	18.3	18.2	93.8	17.7
North Carolina	32.4	32.3	77.8	—
South Carolina	31.0	31.7	33.6	25.5
Georgia	24.7	32.7	34.8	22.3
Florida	29.4	28.5	31.5	12.7
EAST SOUTH CENTRAL	18.9	20.0	32.6	15.9
Kentucky	19.9	19.7	—	21.1
Tennessee	19.5	19.9	44.3	14.9
Alabama	19.4	20.3	—	16.9
Mississippi	13.6	—	31.9	13.4
WEST SOUTH CENTRAL	9.6	11.4	44.0	9.5
Arkansas	14.7	—	41.7	14.5
Louisiana	10.2	—	31.6	10.2
Oklahoma	10.8	11.4	59.2	10.8
Texas	8.8	—	44.4	8.7
MOUNTAIN	20.3	23.0	24.5	18.5
Montana	16.8	—	15.7	19.4
Idaho	—	—	—	—
Wyoming	18.4	17.3	81.3	19.5
Colorado	18.2	23.7	37.4	15.8
New Mexico	19.2	29.0	70.1	18.9
Arizona	22.2	—	70.5	21.9
Utah	25.4	25.3	25.8	22.7
Nevada	112.0	—	112.0	—
PACIFIC	25.9	13.3[f]	28.7	24.0
Washington	31.6	—	31.6	—
Oregon	19.2	13.3[f]	35.7	—
California	26.0	—	28.5	24.0

a—Includes bituminous and anthracite and relatively small amounts of coke, lignite, wood and corn residue

b—Includes fuel oil, crude oil and small amounts of tar and gasoline

c—Includes natural, manufactured and waste gas

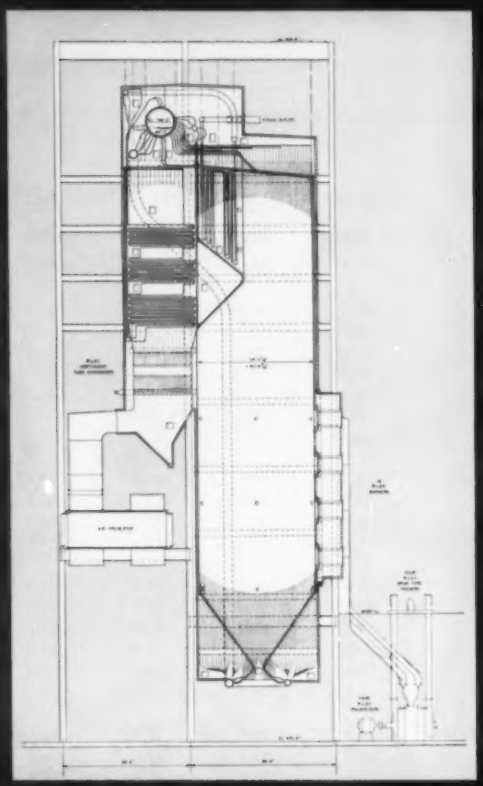
d—Includes bbl of oil converted to equivalent tons of coal

e—Screenings

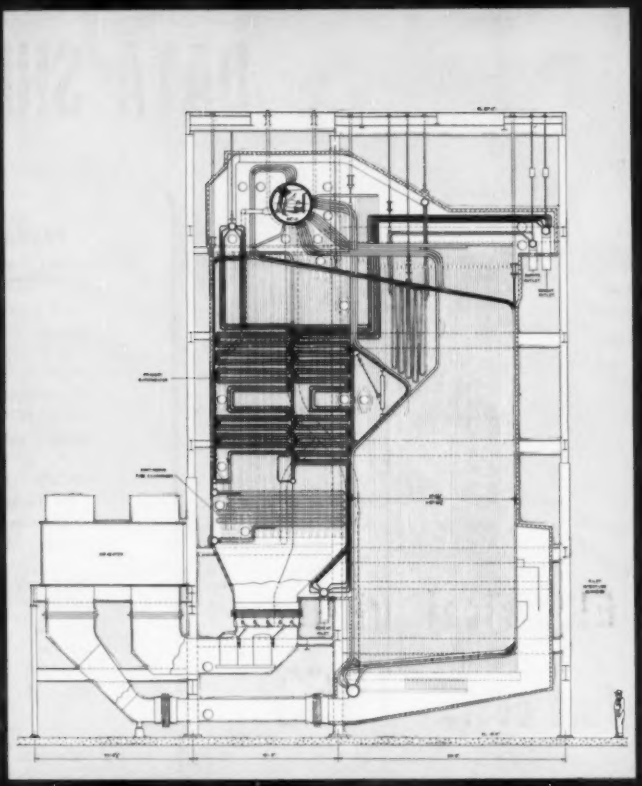
f—Cords and cu ft of hogged wood converted to pounds and tons

SOURCE: Edison Electric Institute

POWER pays $35 for each accepted Data Sheet. Why not submit yours today?



For Picway Steam Station
Columbus & Southern Ohio Electric Co.
900,000 lbs/hr; 1500 psig; 950 F; Eff. 86.5%

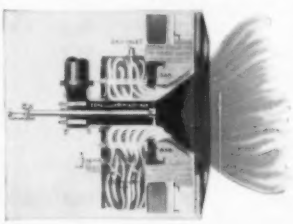


For Teche Power Station
Central Louisiana Electric Company
350,000 lbs/hr; 1650 psig; 1005F/1005F Reheat; Eff. 84.8%

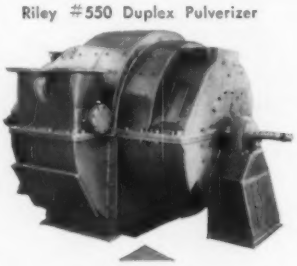
FUEL: OHIO STRIP MINE COAL

This unit was designed to operate under peaking load conditions with Ohio Strip Mine Coal having a moisture content of 16% and containing 10% ash, with Btu of 10,500 and fusion temperature of 2100 F. These coal specifications warranted a furnace with a heat release of 13,500 Btu per cu. ft. of volume, and 85,000 Btu per sq. ft. of projected envelope. The unit is fired by 16 Riley Flare Type Burners and four 15 ton-per-hour Riley #550 Duplex Pulverizers. Erosion resistant tungsten carbide faced pulverizing parts in the mills assure sustained high fineness and low maintenance cost over months of continuous operation. Commonwealth Associates, Engineers

Riley Flare Type Burner



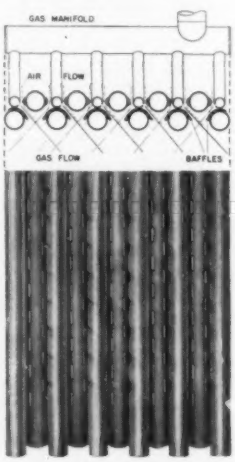
Riley #550 Duplex Pulverizer



FUEL: NATURAL GAS

This relatively small compact Riley pressurized unit will provide the economy of reheat to power a turbine with a nominal rating of 50,000 kw. New Riley Intertube Gas Burners for firing natural gas make possible low excess air, and eliminate exposed burner refractory. "Wall of Flame" characteristic of this new Riley burner provides unusual uniformity of heat distribution across furnace with uniform heat absorption across superheater. Superheat and reheat temperatures are maintained by a combination of spray for superheat and damper control for reheat. Sargent & Lundy, Engineers.

Riley Intertube Burner

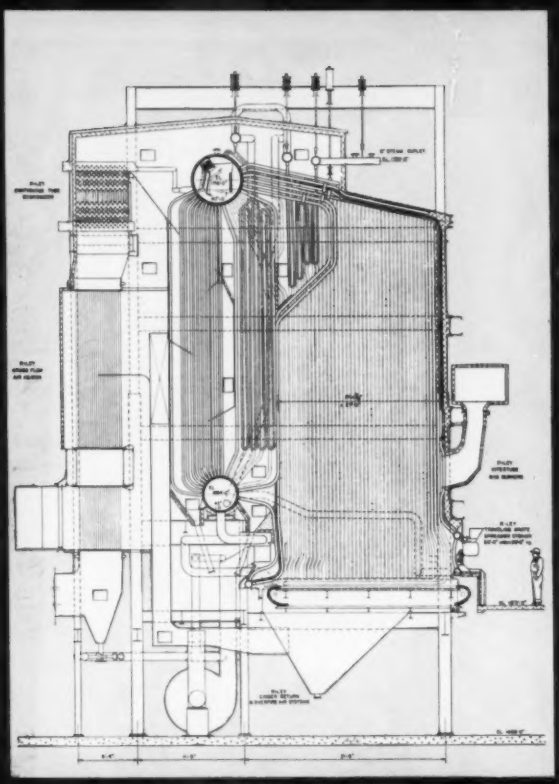


RILEY INTERTUBE GAS BURNERS
Notice absence of refractory. Front row of tubes are part of waterwall, and provides water-cooled protection to gas burners.

COMPLETE STEAM GENERATING UNITS AND FUEL BURNING EQUIPMENT

RILEY steam generating units

. . . selected for high yearly net efficiency, continuity of operation and dependability . . . three of the many Riley units recently purchased by leading public utility companies: In the past few years there has been a decided swing to Riley because of satisfactory performance of hundreds of existing Riley units.



For R. M. Heskett Station
Montana-Dakota Utilities
250,000 lbs/hr; 1025 psig, 905F; Eff. 79.0%

Here are a few other recent Riley sales to Public Utility Companies—

Louisiana Power & Light Co.	1-1,000,000 lbs/hr Reheat
New Orleans Public Service, Inc.	1-975,000 lbs/hr S.G.U.
Houston Lighting & Power Co.	2-1,250,000 lbs/hr Reheat
Texas Electric Service Co.	1-1,250,000 lbs/hr Reheat
City of Los Angeles	2-1,200,000 lbs/hr Reheat
Dallas Power & Light Co.	1-1,050,000 lbs/hr S.G.U.
Monongahela Power Co.— The Potomac Edison Co.	2-700,000 lbs/hr S.G.U.
Southwestern Gas & Electric Co.	1-630,000 lbs/hr S.G.U.
Taiwan Power Co., Taiwan	1-425,000 lbs/hr RX Unit
Florida Power Corporation	1-600,000 lbs/hr Reheat
Southern Nevada Power Co.	1-425,000 lbs/hr S.G.U.
Commonwealth Edison Co.	1-450,000 lbs/hr S.G.U.
Public Service Co. of Indiana, Inc.	1-805,000 lbs/hr Reheat
Iowa Electric Light & Power Co.	2-300,000 lbs/hr S.G.U.

A survey of your power plant will possibly show ways of making surprisingly large savings in your power costs.

FUEL: LIGNITE AND NATURAL GAS

This combination of a Riley Traveling Grate Spreader Stoker for burning lignite, and Riley Intertube Burners for natural gas, assures maximum performance whether fuels are burned singly or in combination.

Each method of firing provides even distribution of heat in furnace. There is no exposed refractory in the Riley Intertube Burners and they receive water-cooled protection when firing lignite. Specified steam temperature is maintained regardless of fuel used by Riley heat exchanger in lower drum. Unit also features a Riley single-pass, two-section Air Heater and a Riley Continuous Tube Economizer. Ebasco Services, Engineers.

Riley Traveling Grate Spreader Stoker

RILEY
Stoker Corporation
WORCESTER, MASSACHUSETTS

Boston, New York, Philadelphia, Buffalo, Washington, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Tulsa, Houston, Denver, Salt Lake City, Los Angeles, San Francisco, Portland, Seattle.

FOR PUBLIC UTILITIES AND INDUSTRIAL POWER AND HEATING PLANTS

MAINTENANCE MEN PREFER
O-B GLOBE VALVES BECAUSE . . .

Free Swivel Action

increases disc life

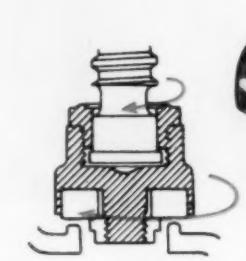
● The longer a valve gives good service the simpler the job of maintaining it. Composition discs in O-B globe and angle valves are made of the best available material. They are protected from gouging and grinding by the free swiveling action of the disc holder.

Here's how free swivel action works to protect disc and seat. When the valve is being closed, the stem and disc turn as a unit until the disc is firmly seated. Then the disc stays practically stationary as the stem continues to turn. The stem action exerts downward pressure on the disc but does not force it to turn after it is seated. Unnecessary grinding of disc against seat is eliminated.

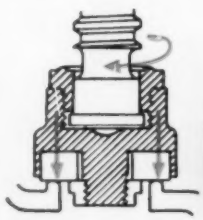
Because of free swivel action, discs last longer, saving maintenance time and eliminating unnecessary interruptions of production.

Free swivel action is one of the reasons that many industrial companies have standardized on O-B valves. If you aren't using them, ask your Ohio Brass distributor to tell you about the O-B line of bronze valves for industry.

Ohio Brass Company
Mansfield, Ohio



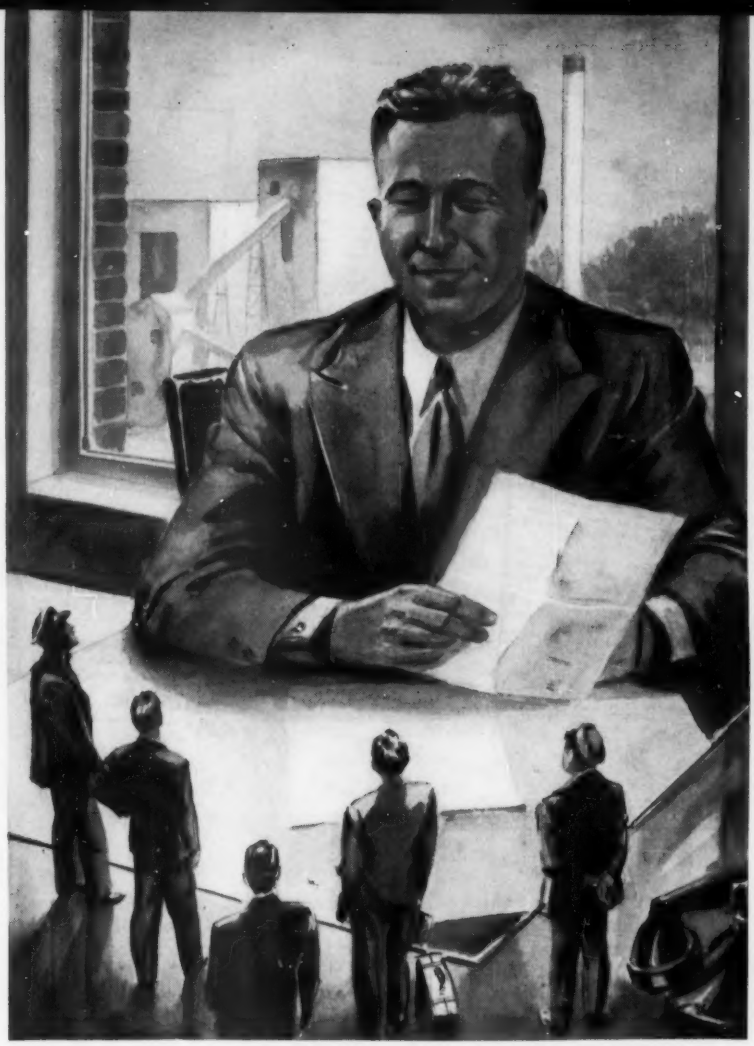
After disc contacts seat, disc rotation ceases, but downward pressure continues to increase as stem is turned.



Ohio Brass Valves

BRONZE GLOBES, ANGLES, GATES AND CHECKS FOR
INDUSTRIAL AND DOMESTIC SERVICES

4448-V



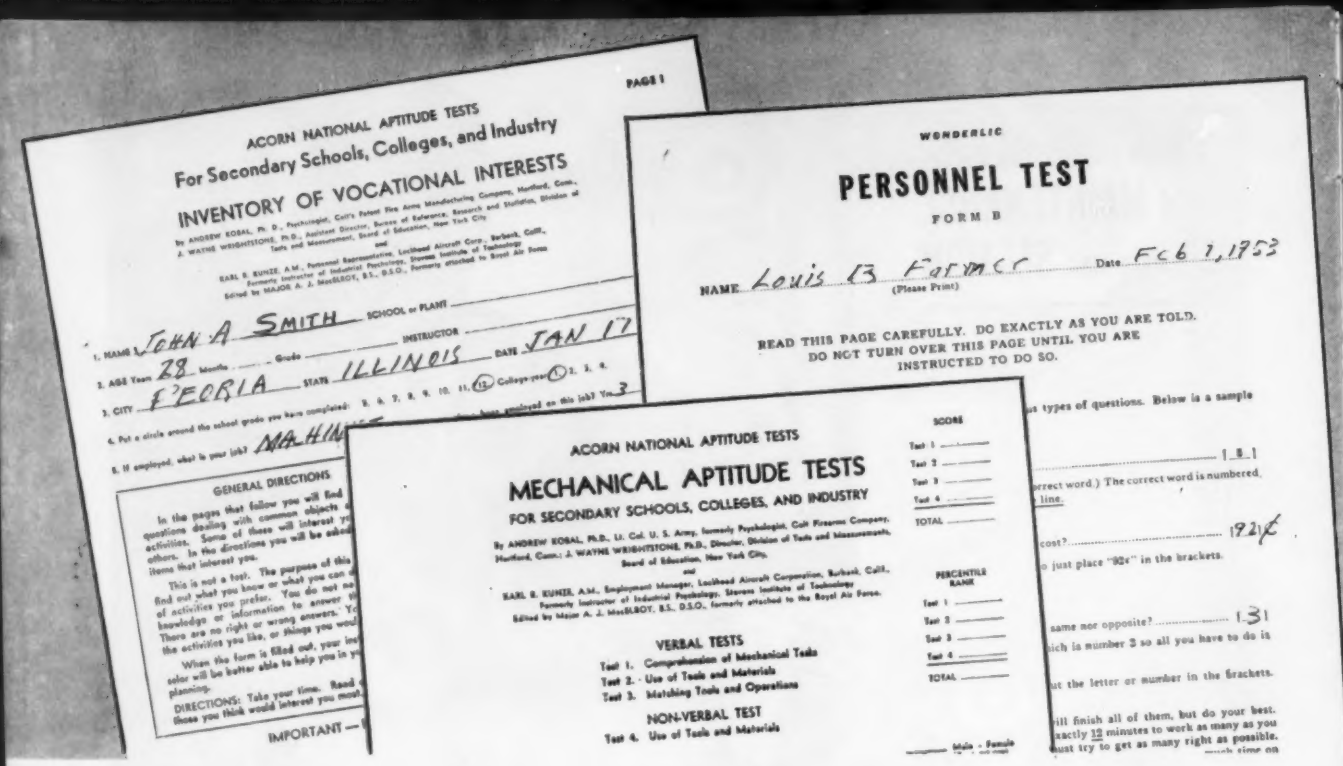
Chief Engineer K M White of new Midwestern plant tells how to screen applicants before...

Selecting your plant personnel

► WHEN BUILDING a power plant it's smart to start hiring personnel early. This is particularly true if you build in the wide, open spaces—away from the skilled-labor market as we are. Our new plant is in Chamois, Missouri, a town of 700 people on the Missouri River.

Plant is small, with a 15,000-kw turbine and a 160,000-lb-per-hr boiler operating at 900 psi and 900 F. We need three men on a shift: shift engineer, boiler-turbine engineer and auxiliary operator. The last is the only inexperienced man we can hire for the operating crew of a shift. We didn't have to hire maintenance helpers, clerks, janitors, etc, until the plant was almost finished.

Because the community is small there were no local men with experience. We did have a few applications from men on Missouri River boats, but they were either older or had had little plant experience. We started placing ads in various papers four months before employing anyone. But this early hiring presents the problem of utilizing time once men are on a payroll. *Turn page*



SELECTING PERSONNEL continued

We placed ads in Midwestern papers, in Springfield, Illinois; Omaha, Nebraska; Waterloo, Iowa; Tulsa, Oklahoma; Little Rock, Arkansas. Those answering were sent application blanks. When the filled blanks were returned, we screened them. Applicants who appeared OK were asked to report for processing. To cut down the periods, 20 to 25 were processed in a group.

Processing tests were general-intelligence, mechanical-comprehension and general-preference. For experienced personnel, we prepared and mimeographed practical tests covering plant operation and maintenance. This gave us a great deal of information about each applicant. (*Editor's note*: If your state has engineer's license requirements, you may not need practical tests.)

Tests were very helpful. Your judgment of a fellow may be about right, but tests help weed out those who aren't. We investigate before buying equipment, so why not do the same when investing in employes? Besides, today it's often less expensive to get rid of bad equipment than a poor employe.

From experience we knew approximate ratings that good plant engineers should have. But tests brought out some odd situations. Several men scored zero on the IQ test. A janitor should score at least 8 to 10 on this test. One of these zeros was by a fellow who had fired in a power plant. He couldn't answer, "What is the last month of the year?" So how could he efficiently and safely operate a boiler?

One low scorer admitted he got nervous under strain. But what kind of an operator would he make in an emergency? No doubt fellows like him are lost when things go wrong. In my own experience I remember one engineer who ran out of the plant to get help.

We also had a few men with IQ's too high for a plant operator. Don't forget you can over-hire as well as under-hire. While we had to process over 200 applicants, this was necessary to select the 20 we finally hired.

First man was hired in January. We started off with plant electrician, two shift engineers and one boiler-turbine operator. These men were to help start our training program. First job for these four men was to get acquainted with the plant. They did this by studying various prints and touring the plant. Then they started filing and indexing blueprints, numbering and cataloging tools, checking miscellaneous materials, etc. Two of these men also helped process the remainder of applicants.

Two weeks before hiring other personnel, we made prints of our steam and water cycles for each employe's personal use. Prints were about 11x24 inches and showed each valve and piece of equipment as installed in the plant.

Training program was laid out so experienced men could instruct. Each man was scheduled to be leader of a group for at least one day. We tried to assign a topic each was best qualified to teach. Leaders used blueprints, instruction books, and films. They also visited the plant with a group, where they examined equipment being discussed.

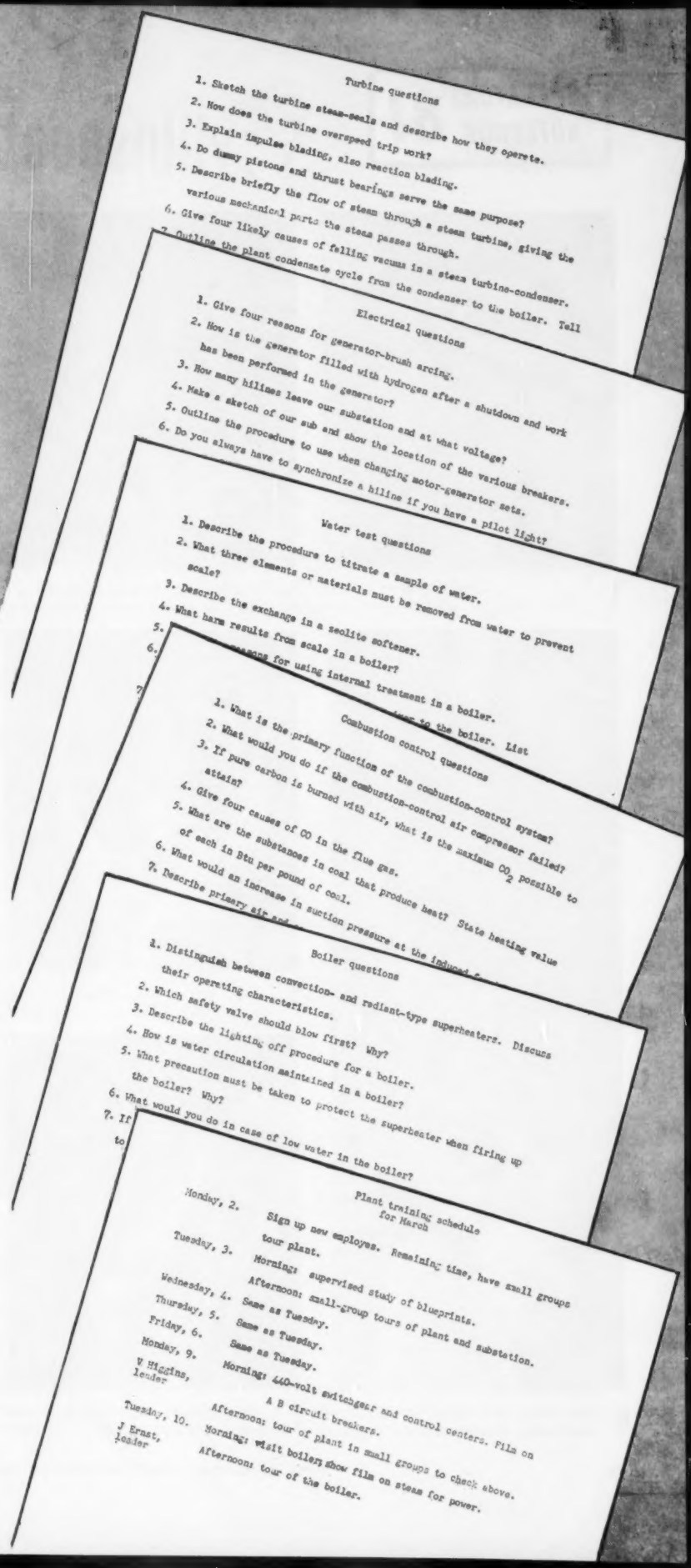
All auxiliary engineers and experienced personnel were hired by March 1. Experienced men were mostly ex-merchant marine men who didn't have experience needed to qualify for shift engineers. We hired them as boiler-turbine engineers. Even if somewhat short in station experience, tests showed they were mechanically inclined, had mental ability for the job. They also knew basic principles of plant operations.

Ex-mariners were told that a series of tests would be given after our training period, and shift engineer's position filled from highest scores. We felt that would give each an incentive to get all he could from the program. Besides, that was fairest way we knew to upgrade.

In the first week of training we got acquainted with each other, then small groups studied prints, and toured the plant. Thus each man became familiar with equipment and what part it played in plant cycle. That was a good start.

BATTERY OF PREPARED TESTS gave us some idea of applicant's aptitude for things mechanical, vocational interests and also his general education. These tests were very helpful and brought to light some interesting things that we could not have learned without them. They helped us eliminate a number of applicants, saving us lots of time and work

PRACTICAL TESTS were necessary because no licenses are required to work in a power plant in our community. Tests shown are about the same that would be required to pass some operators' license tests that we know of. Men who answered these correctly have turned out to be very reliable in operating our new plant



Turbine questions

1. Sketch the turbine steam-seals and describe how they operate.
2. How does the turbine overspeed trip work?
3. Explain impulse blading, also reaction blading.
4. Do dummy pistons and thrust bearings serve the same purpose?
5. Describe briefly the flow of steam through a steam turbine, giving the various mechanical parts the steam passes through.
6. Give four likely causes of falling vacuum in a steam turbine-condenser.
7. Outline the plant condensate cycle from the condenser to the boiler. Tell

Electrical questions

1. Give four reasons for generator-brush arcing.
2. How is the generator filled with hydrogen after a shutdown and work has been performed in the generator?
3. How many hilines leave our substation and at what voltage?
4. Make a sketch of our sub and show the location of the various breakers.
5. Outline the procedure to use when changing motor-generator sets.
6. Do you always have to synchronize a hiline if you have a pilot light?

Water test questions

1. Describe the procedure to titrate a sample of water.
2. What three elements or materials must be removed from water to prevent scale?
3. Describe the exchange in a zeolite softener.
4. What harm results from scale in a boiler?
5.
6.

Combustion control questions

1. What is the primary function of the combustion-control air compressor failed?
2. What would you do if the combustion-control air compressor failed?
3. If pure carbon is burned with air, what is the maximum CO_2 possible to attain?
4. Give four causes of CO in the flue gas.
5. What are the substances in coal that produce heat? State heating value of each in Btu per pound of coal.
6. What would an increase in suction pressure at the induced
7. Describe primary air and

Boiler questions

1. Distinguish between convection- and radiant-type superheaters. Discuss their operating characteristics.
2. Which safety valve should blow first? Why?
3. Describe the lighting off procedure for a boiler.
4. How is water circulation maintained in a boiler?
5. What precaution must be taken to protect the superheater when firing up the boiler? Why?
6. What would you do in case of low water in the boiler?
7. If
to

Plant training schedule
for March

Monday, 2. Sign up new employes. Remaining time, have small groups tour plant.

Tuesday, 3. Morning: supervised study of blueprints.
Afternoon: small-group tours of plant and substation.

Wednesday, 4. Same as Tuesday.

Thursday, 5. Same as Tuesday.

Friday, 6. Same as Tuesday.

Monday, 9. Morning: 440-volt switchgear and control centers. Film on
W Higgins, leader A B circuit breakers.

Tuesday, 10. Afternoon: tour of plant in small groups to check above.
J Ernst, leader Morning: visit boilers; show film on steam for power.
Afternoon: tour of the boiler.

Our group instruction periods were started the second week. Each employe was scheduled as leader for one day and assigned a topic. Instruction periods during first few days were handled by employes hired in January. Newer men then took over. This system worked out surprisingly well. Each person studied his subject and took great interest in his topic. Result was good instruction periods. This also showed us who was best qualified in each phase of plant operation. We believed that taking part in training also helped thaw out self-conscious men. It gave them confidence because we let each talk on the subject he knew best. Having men teach also took training load off one man's shoulders.

Here are typical discussion-period subjects:

1. Boiler lighting-off procedure. Recommended mill temperature limits, load limits, boiler design, theory of circulation, superheater control and shutdown procedures.

2. Turbine design, starting-up procedure, specific requirements for vacuum, generator, oil and exhaust hood temperature, turning gear engagement, bearings, operation of drains.

3. Electrical equipment, sub design and operation, transformers, meters, controls, etc, and how to isolate an ocb.

To break up class-room monotony, we

(*Continued on page* 212)

OPERATORS' NOTEBOOK 81

Inspect the fire side

1 Check the cross box and down-comers in rear pass for leakage—corrosion

2 Trouble often starts on generating tubes near soot blowers. Look for signs of thinning and erosion from steam impinging on tubes. This is an important check

6 Look along the tubes for signs of overheating, bulging and also sagging

7 Easiest way to find bowed tubes in many boilers is to use straightedge

8 Inspect overhead baffles and bridgewall for leakage, tubes for corrosion

9 Leakage between tube and wall here can cause a blasting effect on tube

10 Check brickwork for cracks, spalling, and for its general condition

# of your boiler carefully: 2

By STEVE ELONKA,
Associate Editor

3 Check position of soot-blower holes for their even spacing between tubes

4 Look into superheater header to see condition of tubes, also the headers

5 Check refractory around burner throat for spalling—for general condition

Here are important trouble spots for you to check

► WE INSPECTED water side of boiler in October (Operators' Notebook 79, pp 122-123). Article pointed out that National Board Inspection Code requires registered power boilers to be inspected at regular intervals. It's up to you to prepare boilers.

After boiler has been emptied, cooled and dumped, open for internal and external inspection. You can't find all defects if boiler is not clean.

Note: Insurance men tell me some of the largest firms won't cooperate in cleaning boiler thoroughly for inspector. No marine engineer thinks of having a marine inspector come aboard until each pass of fire side is blown with hand lance, tubes inside furnace wire-brushed, water side of tubes turbined and boiler thoroughly washed out. Unless boiler is prepared properly, inspection is not made. Why don't insurance firms stick together and refuse to insure a boiler unless it is properly prepared for inspection?

After inspecting water side, inspect fire side thoroughly as shown here.

Bulging, blistering, leaks. Be sure to inspect carefully plate and tube surfaces that are exposed to fire. Look for places that might become deformed by bulging or blistering during operation. Solids in water side of lower generating tubes cause blisters when sludge settles in tubes and water cannot carry away heat. Inspect water side of such deformed areas, then remove whatever solids caused the bulges or blisters.

Bulges and blisters can seriously weaken the plates or tubes. Boiler must be taken out of service until defective part or parts have been properly repaired. Blistered tubes must be cut out and replaced with new, and not hammered into shape.

In vicinity of seams and tube ends, observe boiler structure carefully for leakage. Firetubes sometimes blister, but rarely collapse.

Lap joints, fire cracks. Lap-joint boilers are apt to crack where plates lap in longitudinal or straight seam. If there is evidence of leakage or trouble at this point, you might have to remove rivets or slot the plate to determine whether cracks exist in the seam. Cracks in shell plates are usually dangerous, except fire cracks that run from edge of plate into the rivet holes of girth seams. Usually, a limited number of such fire cracks are not very serious.

Test staybolts by tapping one end of each bolt with a hammer. You get better results by holding hammer or heavy tool at opposite end while tapping.

Tube defects. Tubes in horizontal firetube boilers deteriorate faster at ends toward the fire. Tapping outer surface with light hammer shows if there's serious thinness. Tubes of vertical tubular boilers usually thin at upper ends when exposed to products of combustion. Lack of water cooling is the cause here.

Tubes subject to strong draft often thin from erosion caused by impingement of fuel and ash particles. Soot blowers, improperly used will also thin the tubes. Leaky tube often causes tubes in its vicinity to corrode seriously from water striking soot, causing acid condition. You can lose many tubes in this way.

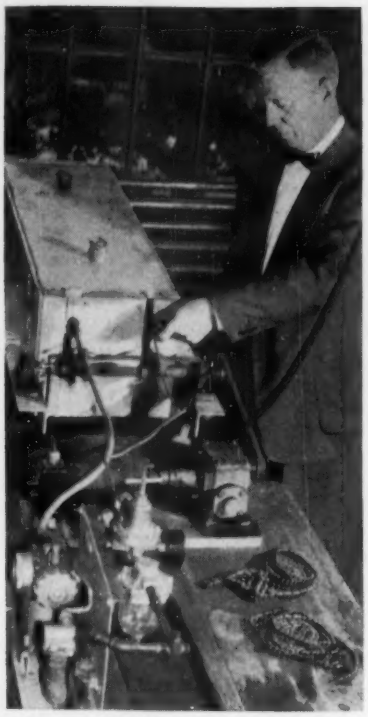
Short tubes or nipples joining drums or headers lodge fuel and ash, then cause corrosion if moisture is present. Clean, then examine all such places thoroughly.

Baffling in watertube boiler. Check to see if baffling is in place. Combustion gas, short circuiting through baffles, raises temperatures on portions of boiler, causing trouble. Check location of combustion arches for right position with relation to tube surfaces.

Heat localization from improper or defective burner or stoker, or operation causing a blowpipe effect, must be corrected to prevent overheating.

When repairs are made, inspect workmanship. Excessive tube rolling is common. Then tube ends are thinned at tube sheets, tube-sheet openings enlarged—both harmful to boiler. Underrolling is also common, especially if tubes are hard to get to. Hydrostatic test will show such leaks and leaky tubes can be rerolled (see Operators' Notebook 31, May 1951, Rolling Tubes).

MEET ROY K TONNING, lubrication engineer with American Can Co. He heads up company-wide lube program, also serves as an adviser to each of 66 scattered plants



WORKING MODELS help speed answers. Here oven-chain lube problem is studied

American Can Co takes a hard look at

Top operating men in big plants are slowly realizing need for staff lubrication engineers. Longer machine life and reduced downtime is the major appeal rather than lower lube costs

► American Can Co is one of a growing number of industrial concerns who are adding lubrication engineers to their staffs. And it pays off. Of course, American Can is big by any of today's standards for sizing organizations. In all, they have 61 manufacturing plants and 5 machine-shop centers. The latter are essentially machine-building and development areas.

Back in 1948, this company employed its first lubrication engineer, Roy K Tonning. Two years later a well-equipped laboratory was set up in their Newark, N. J. technical center to handle the many tests associated with modern big-plant lubrication.

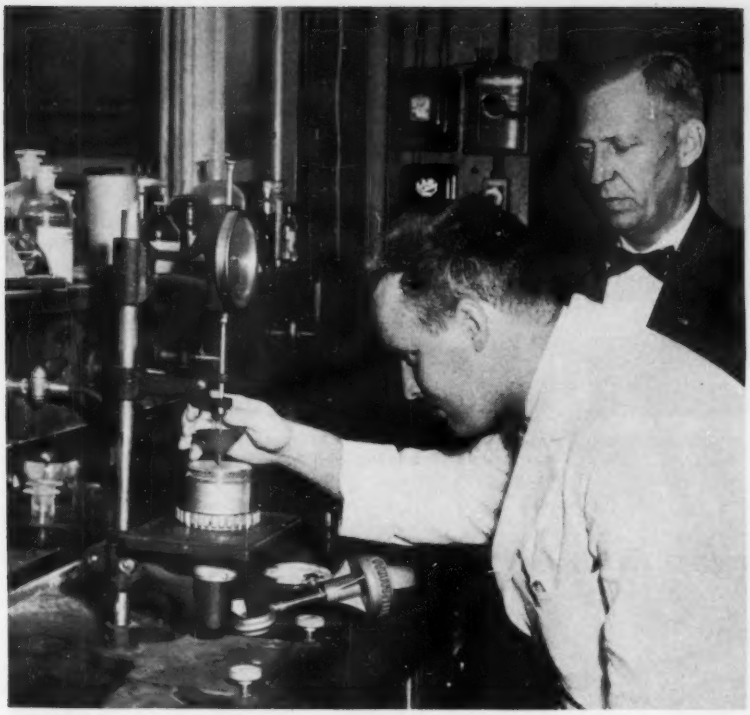
What he does. What can you expect from a lubrication engineer on your staff? Well, let's set up Tonning as an example. Top management looks upon him as a wear-reduction engineer. He serves in an advisory capacity to each of the company plants in solving specific lubrication problems. Tonning concerns himself with the technical side of lubricant purchasing (the company purchasing agent does the actual buying) and the application of those lubricants to plant machinery.

Over-lubrication is a headache in any industry, especially in food and textiles. Many engineers will vouch that a staggering number of motor failures each year in industrial plants can be traced to ambitious but untrained lads assigned to motor lubrication. Moreover, in the food and textile industries, the problem of product contamination, which is always present, can be aggravated by over-lubrication. Checking for possible areas of over-lubrication is one of Tonning's responsibilities.

Actually, the lubrication engineer's work in this company is split between his desk, the laboratory and on-the-job trouble-shooting. He also comes into the picture during the design of new equipment.

Lube laboratory here serves a dual purpose: (1) to check on all new lube products (2) to trouble-shoot field problems. And field problems in American Can often extend into customer's plants. Example: After cans are shipped to brewer or food packer, control tests show a spot of lube is finding its way into the finished product during the packing or final can-sealing operation. Often the lubrication engineer is called in to pinpoint the trouble, find a cure.

Lab is equipped to test viscosity, flash-and-fire, carbon residue, oxidation (oxidation-bomb test), color and grease number. A spectograph is also on hand for lube testing. In addition there is



LUBRICATION LABORATORY is equipped to test viscosity, flash-and-fire, carbon residue, oxidation, color, grease number. Grease penetration number is being checked

Small plant? Here are two tips on handling lubrication

- This 3-page article outlines lubrication practice in a large-plant organization. Smaller plants might hesitate, and rightly so, to consider a full-time lube engineer. What to do?

- First step in sprucing up your present lubrication program is to call in your oil supplier and get the benefit of his experience. Today, all leading oil companies have the facilities to survey your plant and offer you the basis for a modern lubrication program. It's yours for the asking.

- Next step is to become a member of *American Society of Lubrication Engineers.* Whether you are on the design or operating side of the power picture, you'll get an opportunity here to pick the brains of the experts. Get more info about ASLE by writing W P Youngclaus, Executive Secretary, American Society of Lubrication Engineers, 84 E Randolph Street, Chicago 1, Ill.

plant lubrication...and it pays off

the regular equipment found in every chemical lab. A chemist conducts the tests.

Typical problems fall anywhere from selecting the best lubricant for oven-chain lubrication to determining the most economical drain periods for industrial trucks. Chain lubrication is mighty important here. Lithographic ovens operate at 420 F. Each oven is about 130 ft long, requiring about 560 ft of chain. In one plant alone, Hillside, N. J., there are 15 operating ovens.

If a petroleum product is used at these high temperatures a carbon-varnish residue forms, seriously reducing chain life-expectancy. Also, combustion products, formed by the petroleum products at 420 F, contaminate the newly lithographed metal sheets passing through the drying oven.

Furthermore, faulty chain lubrication results in chain chatter, causing wickets supporting the lithographed sheets to vibrate. This movement leaves wicket marks on the sheets. And since there are about 1000 lithographed sheets in the oven at one time, a sizable production loss results should chain chatter.

At present a colloidal graphite suspended in a synthetic oil is used for oven chain lubrication. Automatic methods for lubricant application are fast replacing the old hand-brush technique. This means a regulated supply of lubricant rather than a feast-and-famine delivery, as is the case when lubricant is brushed on.

Industrial trucks come in for their share of study to determine the most suitable lubricant and the proper drain periods. One recent problem was the relatively short life of the engine oil. Trucks, equipped with conventional 1-quart automotive-type filters, had to be drained every 150 hours of operation. Periodic lab tests on an oil sample pinned down drain periods. By changing to larger-capacity (3-quart) industrial-type filters, oil life was increased to about 1000 hours. The larger capacity filters are now being installed on all industrial trucks.

To determine drain periods the following lab tests were run on oil samples: (1) normal pentane insolubility (2) acid number (3) fuel dilution (4) Photovolt light transmission. After plotting the results of a series of such tests the Photovolt light transmission test replaced the normal pentane insolubility test since ample evidence indicated a direct relationship between Photovolt light transmission and degree of contamination. Present thinking leans toward a straight mineral oil with oxidation and corrosion inhibitors for industrial truck engines.

Training plans are a major factor since the success of any planned lubrication program hinges on the skill and common sense of the people who apply the lubricants. Feeling here is that each plant should have an operating man whose major supervisory responsibility is plant lubrication. He is in direct charge of the crew lubricating the plant machinery.

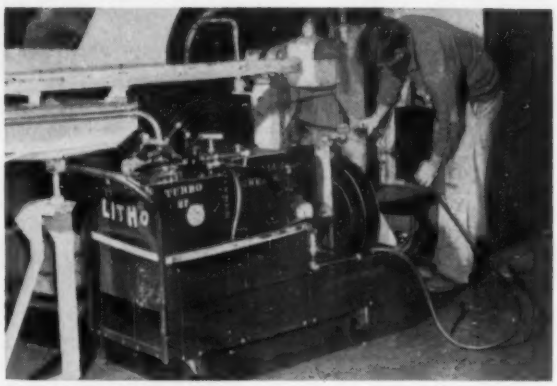
Now watch Lube Engineer Tonning at work: Turn page

TONNING worries with Ray Couche, asst master mechanic, about lube problem affecting can output in Hillside, N. J. plant

TROUBLE TRACED to lithographic oven. If oven chains fail to run smoothly, lithographed sheets chatter on their wickets

Working closely with top men in each plant is key to...

HAND BRUSHING of chain lubricant found inadequate. With this method of application, lubrication is either feast or famine

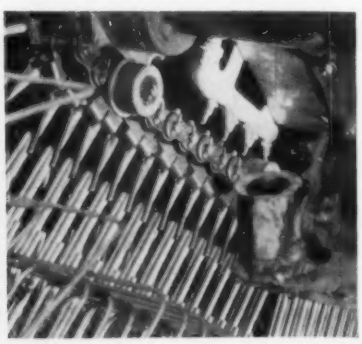


MODERN RIG used for lubrication of all other parts of oven's driving system. Tight lube schedule is carefully adhered to

...selling planned lubrication in large companies

RECOMMENDATION to Couche: Install oil-air lubricating system on oven chains

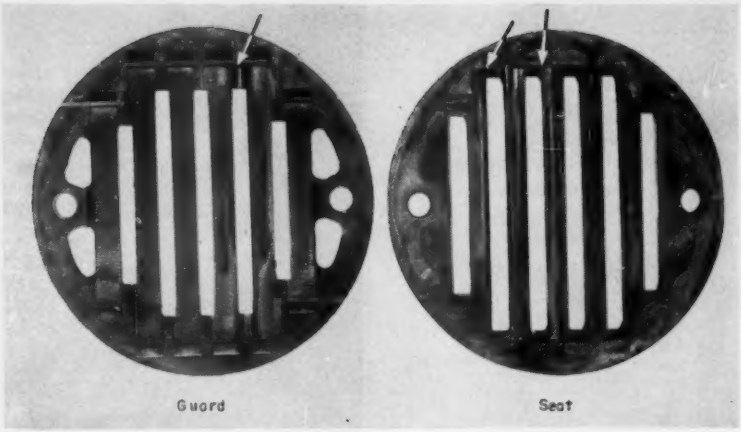
FINAL CHECK on automatic lube dispenser after installation on oven chain



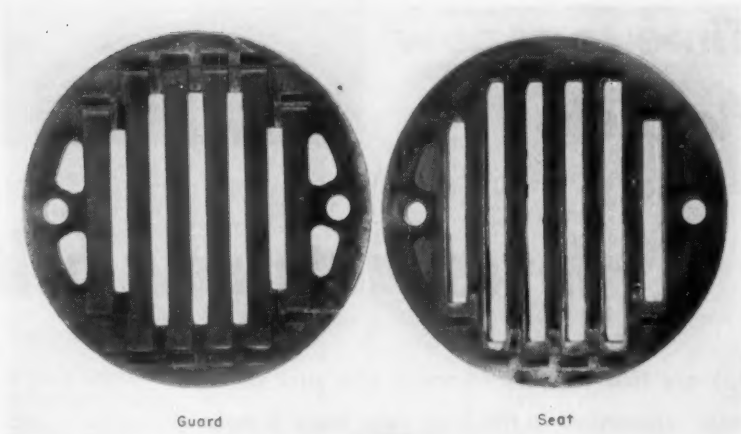
NOZZLES, fed from automatic dispenser, direct controlled oil-air mix on chain

By **WALTER E MAX**, *Manager*
Service and Erection Department
Buffalo Works, Worthington Corporation

Protect your compressor from moisture



WEAR due to moisture made valve guard and seat inoperative after only 650 hours



VALVE GUARDS and seats still in excellent condition after 12,815 service hours

► MOISTURE CAN CAUSE trouble in the operation of your multistage air compressor. And even on the driest day there is some moisture in the air.

For example, 1000 cu ft of air, at atmospheric pressure, 80 F and 40% relative humidity (a reasonably dry day), contains 0.6 lb of moisture. At the same pressure and temperature but with 100% relative humidity, 1000 cu ft of air has 1.5 lb of moisture. This is on a rainy or very humid day.

When air is compressed in the first stage and then cooled in an intercooler. a considerable amount of condensate forms. This water must be disposed of before the air enters the second-stage cylinder. The colder the water to the intercooler, the greater the amount of moisture condensed.

Moisture causes excessive wear on valves, cylinders and rings (see illustrations). The service life of these parts is reduced from a normal span of years to months and, under extreme conditions, to weeks. We have seen cylinders wear 0.030 in. after two weeks of operation when excessive moisture destroyed lubrication effectiveness.

Checking for moisture. First check separator's effectiveness in removing all entrained moisture. This is in small droplets carried by the saturated air. Inspection of the suction port and valves of the cylinder after the intercooler tells whether the separator is doing its job removing these water droplets.

If excessive condensate is carried past the separator, pools of water and some lubricating oil from the first-stage cylinder are evident in the port. Valves have a pitted or sand-blasted appearance and the seat and guard show an abnormal rate of wear.

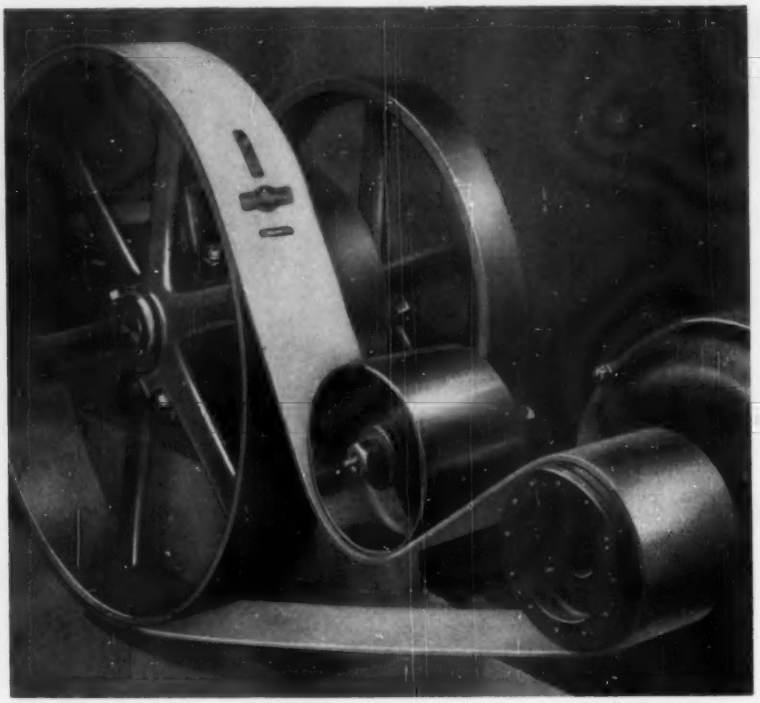
If the separator is working OK, the automatic drain trap may not be properly draining water accumulated in the separator. The right functioning of this trap is very important.

Recently we heard of a plugged trap in an aftercooler. Accumulated water and lubricating oil were carried into the system, resulting in an explosion due to the excessive oil present. Failure of a single trap in this case caused considerable damage and downtime.

With both the separator and the trap working properly, air entering the next cylinder is free of entrained moisture. But the air is at 100% relative humidity. And if the air temperature is reduced by any amount, condensate forms.

Recommendations. Maintain the cooling-water temperature in the compressor cylinder at least 10 to 15 F warmer than the incoming air or gas. This prevents condensation when saturated air hits water-jacketed wall of the cylinder. If cooling water is not warm enough, it may be necessary to pipe it in series so that it goes first to the intercooler, then to the first-stage and finally to the second-stage jacket. Piping system selected is entirely dependent on the temperature of the cooling water available.

Should moisture condition persist, it is good policy to use a compounded oil in the cylinder. This oil mixes with water and provides a lubricant that reduces rate of wear.



Time to renew flat belts?

Investigate new belt materials...

Balance first cost with service life, pick drive most economical in the long run. Here is help in choosing the best renewal belt

BECAUSE flat-belt renewals represent business running into millions of dollars a year, manufacturers are constantly making improvements in design.

Take advantage of this when replacing worn drives. Be sure to specify the best type of belt now available for the application. Material may be different from what you had before. Finally, recheck the design.

Belt materials. Rayon or other synthetic fabric instead of cotton duck, for instance, may permit thinner belts. This means less heat build-up in flexing around the pulley, and, therefore, longer life. You also get a slight weight reduction.

Flat-belt types in use today include rubberized cotton duck or other fabric, rubberized cord, steel cable encased in duck, balata-impregnated fabric, unimpregnated stitched duck, and leather. Each serves a particular field best. Manufacturers' literature gives much helpful information on best belt material for special applications.

A rubberized transmission belt is almost all fabric, or cord, as these materials carry the load. However, some rubber is used. Better rubber compounds available today add to belt life by improving adhesion, reducing effects of oxidation, resisting wear and abrasion.

Splicing plays an important part in belt life. Metal fasteners are most widely used. Select the correct size and type for the particular application. Installed correctly and well maintained, fasteners give good service. Belts joined with them can be shortened when necessary.

For heavy duty, flat belts can also be furnished in endless form, with vulcanized splices made at the factory.

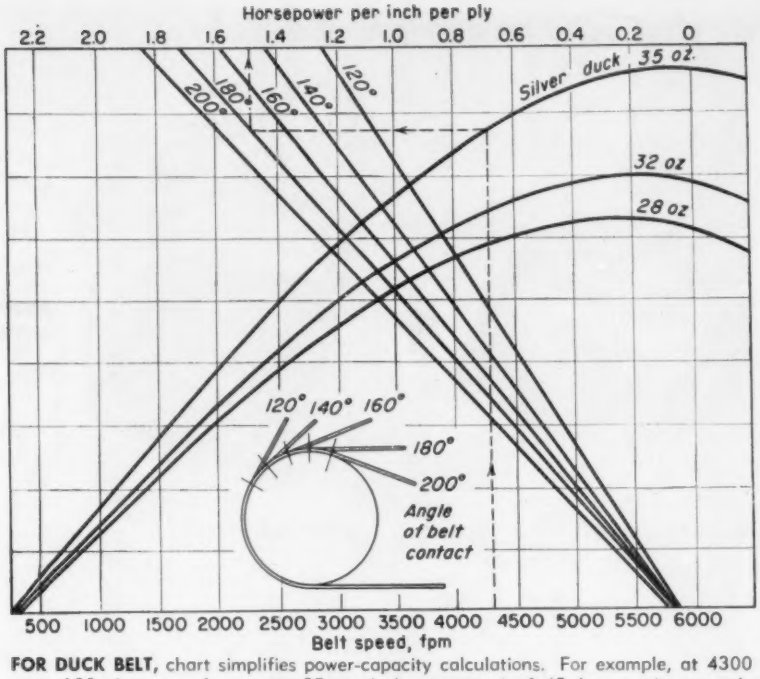
Causes of failure of the old belt give clues to remedial action that may be required.

Were tension and alignment OK? A flat belt must be tight enough even at peak horsepower load to keep slip below 2%, if it is to stay on the pulley. Check the alignment —even slight misalignment causes trouble with belt running crooked. Be sure belt runs so point entering pulley is at right angles to pulley axis.

Did takeup prove adequate on the original installation? Are pulleys and idlers in good condition, and large enough to avoid excessive belt flexing? Are there any unnecessary obstructions, flanges, belt guides or shifters tending to fray, tear or unravel the belt? Is the atmosphere as free as possible from oil, moisture, dust, corrosive vapors, abrasives?

For angular drives, is there enough space between pulleys to permit belt to turn or change its plane? Do guide pulleys assure minimum belt flexing? When making up the angular drive belt, was provision made for giving it a half-turn, or making one edge longer than the other? Is installation designed carefully so drive can be reversed if necessary?

Recheck the design. When renewing a belt, rechecking the design will insure the best possible service. Points to consider include load, belt capacity, width and plies, pulley



FOR DUCK BELT, chart simplifies power-capacity calculations. For example, at 4300 rpm, 180 deg arc of contact, 35-oz duck capacity is 1.48 hp per in. per ply

Here's a check list of 6 items

1. Are you using the best type of belting material for this application?
2. Is it the right size?
3. Are the tension and alignment OK?
4. Pulleys large enough?
5. Idlers the right size and at the best location?
6. Have you eliminated needless obstructions, oil or water dripping on belt?

recheck design

diameters, speed, arc of contact, idler diameter and location. Consult handbooks or manufacturers' literature.

For duck belt, chart above simplifies the calculations. First, determine belt capacity required. If driver horsepower has been selected correctly, belt capacity must be driver horsepower multiplied by service factor for the driven machine.

Then find the power capacity of the belt, in horsepower per inch per ply for the fabric selected at the belt speed and angle of contact involved. Belt speed, fpm, is the circumference of either pulley, in feet, multiplied by its rpm. The smaller angle of contact is approximately the following:

$$180 - [60\ (D - d)] \div C$$

where D is diameter of larger pulley, inches
d is diameter of smaller pulley, inches
C is center distance between pulleys, inches

Chart above includes corrections for the effects of centrifugal tension. For belt's power capacity, find belt speed on bottom scale, move up to weight-of-duck curve. Then turn horizontally to angle-of-contact line. Proceed up to top scale, and read capacity in horsepower per inch per ply.

Total capacity required, divided by power per inch per ply, gives product of belt width, inches, multiplied by number of plies in belt (abbreviated as *wp product*). Any belt in table, *right,* Well-proportioned belting, with wp product equal to or greater than the value required, is OK, if pulley diameters are big enough. Check this in bottom table.

In practice, tendency is to use the widest possible belt, as it will be thinner and have a greater flex life.

This article is based on information supplied by the Thermoid Company of Trenton, New Jersey.

Well-proportioned rubber belting

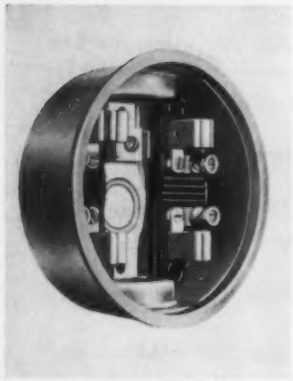
Belt width (inches)	Plies Minimum	Plies Maximum	Belt width (inches)	Plies Minimum	Plies Maximum
2	3	4	18	5	8
3	3	5	20	5	8
4	3	5	22	5	8
5	4	5	24	6	8
6	4	6	26	6	9
8	4	6	28	6	9
10	4	6	30	7	10
12	5	7	36	7	10
14	5	7	42	7	10
16	5	7	48	7	12

Pulley diameters versus belt plies

Number of plies	Pulley diameters, in. 35-oz hard duck Minimum	35-oz hard duck Normal	28- and 32-oz soft duck Minimum	28- and 32-oz soft duck Normal
3	4	7	4	6
4	6	9	6	8
5	8	12	8	10
6	10	15	10	14
7	12	18	12	16
8	14	22	14	20
9	16	26	16	24
10	18	30	18	28

Note: Use normal or larger diameters for best results.

New Westinghouse TV-receiver plant eases maintenance problems by...



METER SOCKET

PLUG-IN CABLE RIG

CIRCUIT ANALYZER

installing meter test sockets in over 400 plant circuits, proving...

You can trim electrical maintenance

One big drawback to wider use of test instrument has been the bother of hooking up. Clamp-on meters helped ease this snag, but individual meter sockets are the big step in streamlining plant testing

By G B SAVIERS, *Division Supervisor of Mfg Engineering, Radio TV Div*
and EDWARD MULLAN, *Meter Division*
Westinghouse Electric Corporation

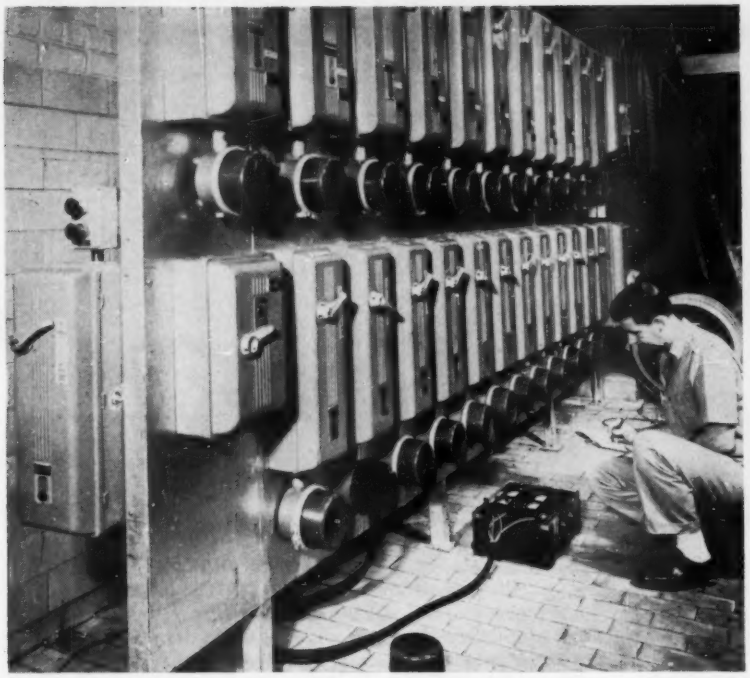
► ALL COST-SAVING TECHNIQUES are of top importance in today's highly competitive television manufacturing industry. So when Westinghouse built a new TV-receiver plant in Metuchen, N. J. the top brass did a lot of head scratching to trim costs. Installation of meter sockets proved one real money saver.

What kind of savings are we talking about anyway? From the motor-maintenance angle alone, test methods described here save about $1 per motor test compared to conventional methods in most of today's plants. Similar savings with other apparatus too.

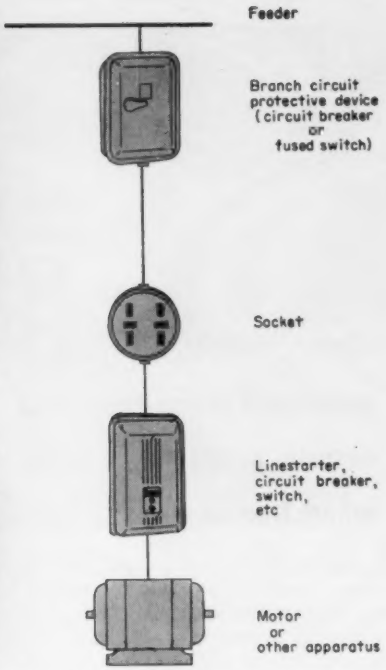
The problem. At Metuchen we have about 300 electric motors in service. Many are on production conveyors and critical processes where failure would result in costly downtime. We also have several ovens with heating elements requiring periodic testing. And, as in most small-part assembly plants, a considerable amount of single-phase power is drawn by the assembly and test benches. We wanted an electrical testing scheme for fast routine-checking of all plant loads, the same setup to serve as a time-saver when real trouble developed. In brief, to spot overloads and anticipate fault with least down-time.

To get the degree of electrical flexibility and trouble-shooting ease we wanted called for some system of routine scheduled inspections plus a simple way to measure voltage, current, watts, etc. We needed a measurement scheme so simple that a meter reader, armed with a portable instrument, can move from spot to spot around the plant and record readings on prepared forms. Then at the end of each day these data can be turned into the Works Engineer's office for analysis. Since operating standards have been previously established for each metering location, it would require little time to glance down each column and check off abnormal readings for investigation.

Our solution. We needed a fast, simple means for inserting instruments into each circuit to get information we wanted. It was also important not to interrupt power at any time, even while hooking up instruments. What was clearly needed was some sort of socket-and-plug arrangement, such as is used with radio tubes. After some searching, the socket used by electrical utilities,



CIRCUIT ANALYZER at work in plant plating room. Sockets, not in use, are sealed off


Feeder
Branch circuit protective device (circuit breaker or fused switch)
Socket
Linestarter, circuit breaker, switch, etc
Motor or other apparatus

TYPICAL HOOKUP: socket in motor line

costs by smart use of instruments

when installing watt-hour meters for residential loads, looked like the best bet. This time-tested device had plenty of current-carrying capacity plus provision for keeping the circuit closed.

A socket was installed in circuits feeding every motor, oven, machine tool, work bench, and process—400 sockets in all. At scheduled times a meter reader records amperes, volts, watts and power factor at each location. On analyzing these data it's easy to spot abnormal operation. Shorted windings show up in unbalanced current readings. Likewise, shorted oven heating elements are fingered by excessive current flow. Readings also spotlight excessive power consumption, low power factor in any area and unbalanced feeder circuits.

Instruments. Backbone of our array of instruments is an industrial analyzer, in use above. This is easy to carry yet contains all instruments and transformers needed to measure in single-phase and polyphase circuits up to 600 v and 125 amp. Simultaneous readings of current, voltage, watts and power factor can be had. Analyzer is plugged into socket with a test-jack and cable rig.

However, measurements other than those provided by the circuit analyzer are necessary at times. Once again, the socket comes to the rescue as a convenient test outlet. Typical of such additional tests is insulation-resistance measurement with a megohmmeter. Also individual socket-type instruments are available that are inserted in any socket permanently or temporarily. For a continuous time record, a recording instrument may be inserted.

How we benefit. This socket measuring scheme has resulted in many benefits and savings. Take the savings in test time alone. Now it's unnecessary to disturb wiring or interrupt manufacturing process when running any electrical test. Instrument needed is simply plugged into the socket. Simplicity is also a factor. Since it is unnecessary to cut into any load circuit, an average plant electrician can take all necessary trouble-shooting measurements.

We've found the socket setup actually tends to avoid emergency breakdowns. Reason is frequent systematic testing often spots trouble as soon as it starts. Also, we've found the tests that go hand in glove with a socket installation allow us to trim back somewhat on our spare-parts inventory. But when all factors are weighed the major benefit is a practical method of testing electrical circuits without disturbing the circuit.

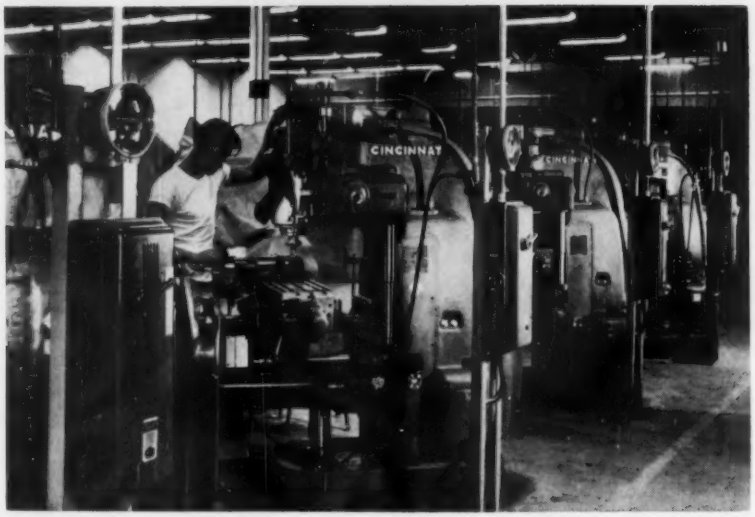
Existing installations. We started from scratch, but there's no reason why an existing plant with an operating distribution system can't install sockets. Merely add them to line starters, circuit breakers, switch boxes, lighting or power-distribution panels.

Remember, sockets are self-supporting when installed in a conduit run and thus no additional mounting support is needed. They can also be built into a machine or mounted on a wall. Once the socket is installed and properly connected all apparatus and circuits are available for test.

The following two pages outline many ways we use sockets. Note that volts, amperes, watts, power factor, watt-hour measurements are taken by simply inserting the correct instrument. Both recording and indicating instruments can be used.

Turn page

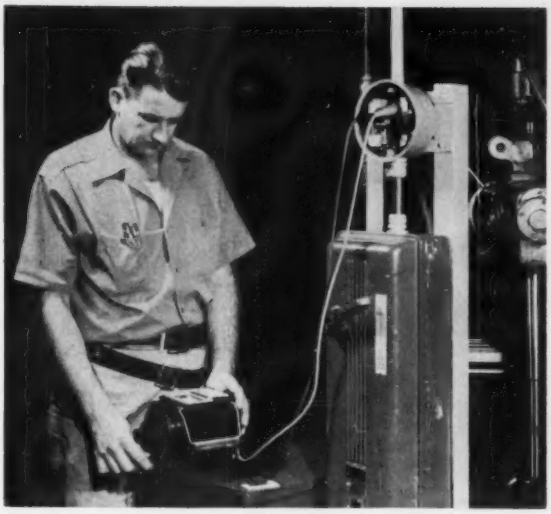
Meter sockets, spotted in motor and heavy apparatus circuits, prove a time-saver when trouble pops



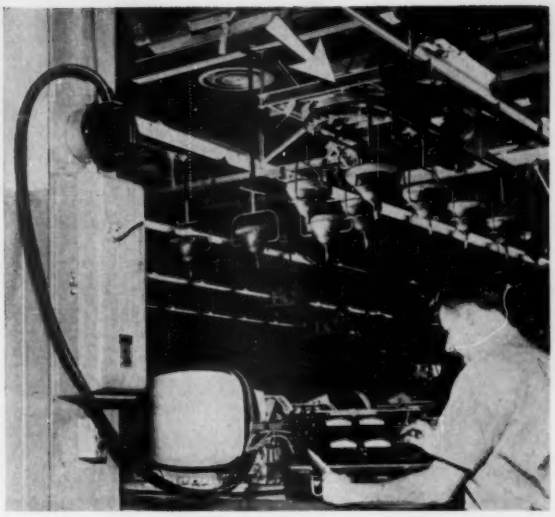
MILLING MACHINES are each equipped with a meter socket tied in just before the motor starter. Here socket is mounted on same bracket that supports starter. Note flexible conduit, joining motor starter and the socket. When not in use, all meter sockets are sealed off with flat-glass cover plates for safety. All machines are fed from overhead bus duct. Plant electrical trouble-shooters make meter sockets their first stopping point, in addition to using them in routine instrument checks. Tests are made without interfering with production since meter socket keeps its jaws electrically closed till meter or test jack is inserted

Instruments and meters may be left in sockets for continuous record of electrical load conditions

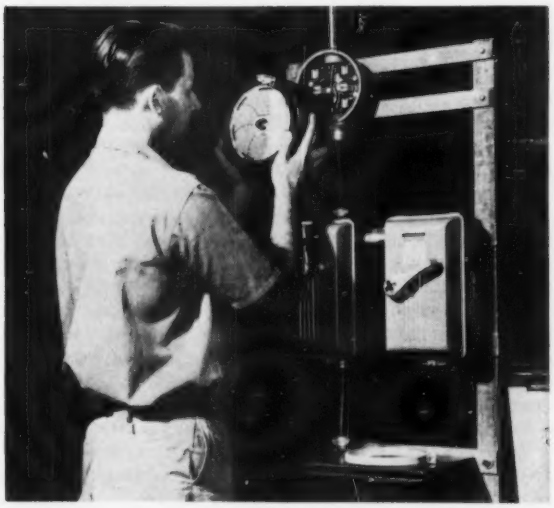
PRODUCTION ASSEMBLY BENCH has ammeter in socket to check on current drawn. Measurement is taken to spot possible overloading. Check on voltage, supplied to bench lighting, can be made at this same point by merely inserting a voltmeter in place of the ammeter. Total absence of loose connecting leads, necessary with bench-type portable instruments, reduces accident possibilities especially around unskilled production workers. Remember, the only investment at installation time is in sockets and slight additional wiring. Specific instruments and meters, judged necessary for your plant, can be purchased later as need dictates



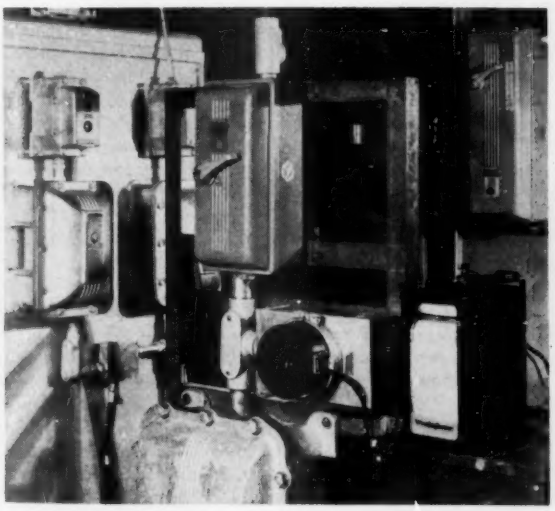
INSULATION RESISTANCE check can be made right at socket after making sure line is dead. Also, by locating socket on the line side of motor starter, check can be made on feeder, control, motor and starter at the same time. By isolating clips in socket, measurements can be taken on feeder or motor circuit from same point in circuit. Keep record of megohm-meter readings for comparison at later date. Any change in insulation resistance is important



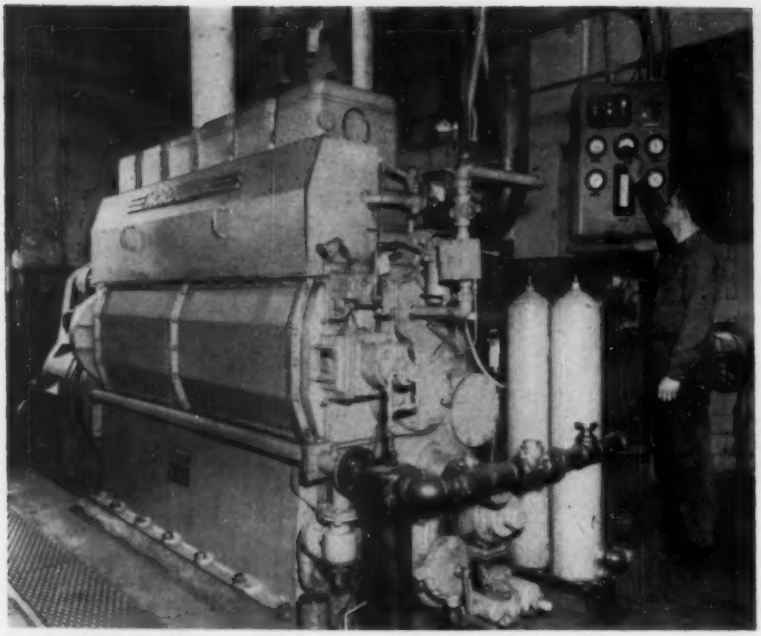
CONVEYOR DRIVE is being checked here by simply plugging circuit analyzer into meter socket and noting voltage, current, power factors, watts. No need to interfere with conveyor operation. It's important that this conveyor line be kept rolling since the 2000 TV-picture tubes it delivers in an average day must reach the high-speed assembly lines; otherwise, there will be a general production delay. Note meter socket permits testing at floor level



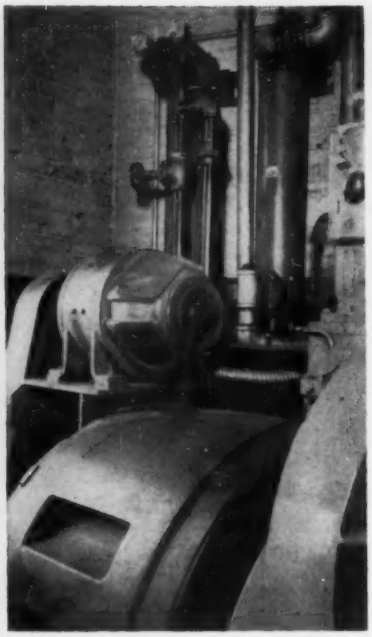
RECORDING METER that plugs directly into socket is used here to study power-consumption pattern of a salt bath used in heat treating. After completing this, and similar tests on other high loads, it was possible to schedule operation at times of low plant demand, avoiding the penalties of upping the over-all plant peak demand. At the end of each recording period, charts are sent to Works Engineer's office. Maintenance plans are often based on chart data



PORTABLE RECORDER is connected here through test jack to measure oven load over a given period. Note trough-type socket used in this case to accommodate heavy conductors oven requires. Oven operates on a 24-hr basis, with close temperature control. This test was run to determine the oven cycling time. Results clearly indicated thermostat was operating under too wide a temperature variation. Thermostat was adjusted to closer tolerance



CHIEF ENGINEER Alfred Jakubek adjusts exhaust pyrometer on completely equipped gage panel of new diesel engine in the Cleanart, Inc, laundry plant, Yonkers, N. Y.



CLOSEUP of 175-kw generator and its 5-kw exciter, V-belted off generator shaft

Save laundry-power $$ with good plans

► CLEANART, INC, one of the largest laundry and dry-cleaning establishments in New York's Westchester County, uses power efficiently for its complete line of usual and special services. The story of its load growth is of interest to all plant operators because it shows how good engineering can save dollars while improving capacity and reliability.

Plant load. Cleanart set up its own power plant in 1937 —a 150-kw steam-turbine-driven generator and a 187-hp diesel. By 1941, business began to outstrip capacity, peak load going over 250 kw. So a second diesel, rated at 240 hp, was installed. Total capacity of 425 kw was enough for the war years.

But by 1952 load was again chasing capacity, the plant's annual production topping 620 kwhr with 290-kw peaks. Plant no longer had firm capacity in excess of peak load and faced a serious shutdown if one of the larger units failed.

New engine. To obtain firm capacity and jack over-all economy and efficiency, Cleanart engineers decided to buy a third diesel, big enough to retire the steam turbine to standby. The new 265-hp 175-kw 4-cycle 600-rpm 9x11½-in. 6-cyl Nordberg went on the line in January 1953. It picked up the major load and became the chief power producer.

Costs. Steam turbines operate economically in laundry service when steam and power needs coincide. As in many laundries, average power load varies sharply from hour to hour, ranging in this plant from a 65-kw low to a 305-kw peak. Steam needs vary, too, but not in the same pattern. So turbine exhaust could not be used in the laundry's process line. Being noncondensing, the unit exhausted steam to atmosphere, wasting valuable heat that could be used.

During 1952 while on peaking, the turbine produced 55,086 kwhr, its watertube boiler burning 349,420 gal of No. 6 oil to supply 160-psi 330-F steam to the turbine and process line. In 1953, turbine was on standby, and business rose with an increase in steam demand, yet boiler fuel consumption fell to 298,895 gal. This shows the turbine should be charged with a minimum of 50,525 gal of fuel.

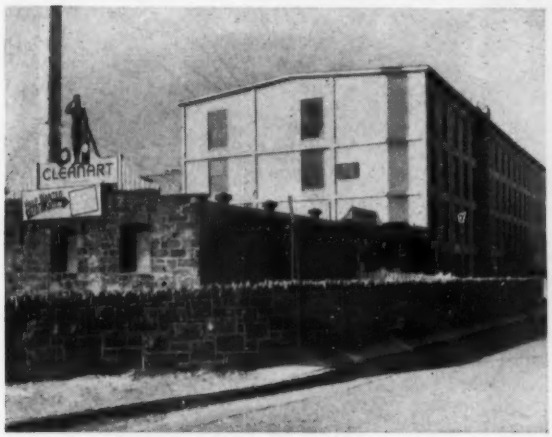
Fuel cost in 1952, with turbine operating and 623,302 kwhr generated, was $10,251.26. In 1953, with new diesel delivering 307,980 kwhr, fuel cost was $8256, while electric production was 751,640 kwhr. At the 1952 cost per kwhr, fuel bill for the larger 1953 output would have been $11,575. Substituting the new diesel for the steam turbine saved more than $3300 in 1953, a cost reduction of over 28%.

Engine loading. Diesel operation is becoming increasingly efficient at Cleanart, overcoming many of the disadvantages of the variable loads. Fluctuating load is not conducive to engine efficiency. Average load factor for new engine has been 63%. Yet its output is 13 kwhr per gal of fuel.

Plant now has firm capacity in excess of peak load, a protection that was lacking in recent years. During its first 14 months, new engine has never had a forced shutdown of any kind, nor has a part been replaced. Three gallons of lube oil are added to the engine every week, giving an average of 4858 hphr per gal. Lube-oil filter is changed every third month of operation.

During a normal day the new engine goes on the line at 7 am and runs continuously until 6 pm. Of the two older engines, larger unit comes on at 6:30 am, goes off at 5 pm. Smaller unit is used for peaking and light-load periods between 4:30 and 7 am, and 6 and 9 pm.

By **MAX FLEISCHER**, *President*
Cleanart, Incorporated



OCCUPYING more than 50,000 sq ft in this building, Cleanart now saves better than 28% in fuel costs with its new diesels

SWITCHBOARD modifications for the new diesel were only minor, showing good planning saves money over life of the plant

backed by dependable generating units

Fuel handling. Trucks deliver No. 2 diesel oil to plant's two steel underground storage tanks: 3000 and 2000 gal. Two transfer pumps, one a standby, move fuel through a strainer and meter to a single 40-gal day tank serving all three engines. Double set of float controls governs the transfer pumps and keeps level in day tank near full capacity.

Separate lines distribute fuel from day tank to each engine. On the new unit an engine-driven booster pump discharges oil through a duplex filter to individual injection pumps and nozzles at each cylinder. Hydraulic governor regulates amount of fuel reaching the nozzles in accordance with load.

Engine cooling. Condensate is used in the closed jacket-water system, eliminating need for water treatment. In normal operation, water enters engine at 140 F, leaves at 158 F.

Raw water for cooling-jacket water and lube oil is also circulated through a closed system. Drawn from a 10,000-gal supply tank, this water is circulated by an engine-driven pump on the new unit. After passing through the jacket-water and lube-oil heat exchangers it is returned to the tank.

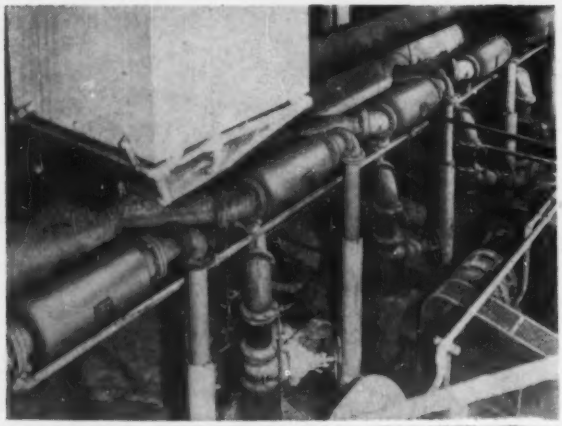
Power use. Besides the power for lighting and for driving its own electrical equipment, Cleanart sells power, at the same rate as the local utility, to two dress firms, a curtain manufacturer, a uniform manufacturer, a sporting goods company, a commercial lab and a box manufacturer. All rent space in the main building or another across the street. Revenue makes the power plant a more attractive financial asset. Of course, private generation of needed power saves a large sum of money.

Here, good planning and dependable equipment are notable for giving new life to a long-established business.

New Diesel Engine and Principal Auxiliary Equipment

Engine, model FS-96 diesel 265 hp, 600 rpm, 6 cyl, 9x11¼ in., 4-cycle	Nordberg Mfg Co
Alternator, model 34G284, type A-1 219 kva, 175 kw, 208/120 v, 608 amp, 8 pf, 3 ph, 60 cycle, with 5-kw 125-v exciter	General Electric Co
Governor	Marquette Metal Products Co
Fuel-oil meter	Neptune Meter Co
Fuel-oil transfer pumps	Viking Pump Co
Fuel-oil duplex filter	Wm W Nugent & Co, Inc
Engine-driven lube pump	Tuthill Pump Co
Lube-oil filter	The Hilliard Corp
Lube-oil strainer	Purolator Products, Inc.
Before-and-after lube pump	Weinman Pump Mfg Co
Lube-oil cooler	Ross Heater Div, Kewanee-Ross Corp
Raw-water pump	Weinman Pump Mfg Co
Jacket-water pump	Weinman Pump Mfg Co
Heat exchanger	Ross Heater Div, Kewanee-Ross Corp
Thermostatic bypass valve	Fulton Sylphon Div, Robertshaw-Fulton Controls Co
Water softeners	Permutit Co
Air compressor	Quincy Compressor Co
Air-intake filter-silencer	Air-Maze Corp
Exhaust silencer	Maxim Silencer Co
Exhaust pyrometer	Illinois Testing Laboratories, Inc
Gage panel	Nordberg Mfg Co
Gages	J E Lonergan Co
Fuel oil	No. 2, Gulf Oil Co
Lube oil	DTE No. 4, Socony-Vacuum Oil Co

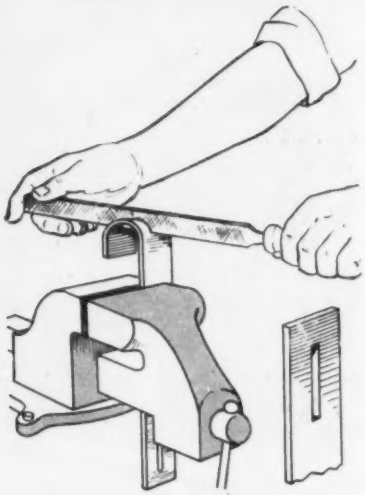
Timely PRACTICAL IDEAS that will help you do a



Now, purifier solves fire-hazard problem

FIVE VACUUM PUMPS in this pigment plant exhausted large quantities of entrained oil that covered nearby equipment and buildings. Besides being a nuisance, oil is a serious fire hazard.

We corrected this condition by installing line-type horizontal purifiers on manifold from each vacuum pump, photo. Now plant vents oil-free air. *Courtesy, V D Anderson Co, Cleveland*



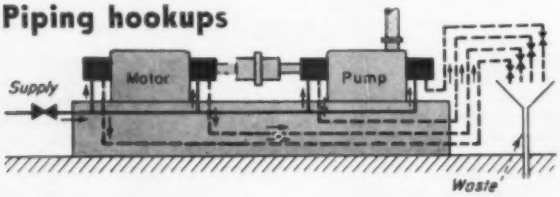
Slot in light stock is easy to make

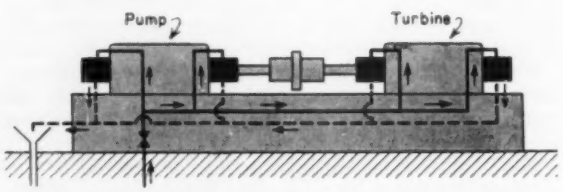
IN FLAT STOCK usual way to make a slot is to drill a series of holes, then chisel and file it out. My sketch shows a quick way to cut a slot in 3/16-in. to ¼-in.-thick stock. Bend stock cold if it is soft and ductile, or heat if of carbon steel or brass. After filing, bend straight and you have a first-class job.

This method can be used on almost any material that can be bent without weakening the material. With a little practice, bends can be taken out by clamping in vise jaws without denting.

C H WILLEY *Penacook, N. H.*

Piping hookups





'Here's my idea,' says OPP

N T PEF shows two piping hookups in Sept, POWER, p 126. On a Navy tanker we had two turbine-driven feed pumps supplying four cross-drum boilers.

We hooked up cooling-water lines, as in my sketch. It worked so well that we hooked up the second feed pump also. Then we made same cooling-water piping changes to our forced-draft blower bearings. In three years on ship we had no bearing temperature trouble.

O P PAULSEN *East Orange, N. J.*

'And here's mine,' says HBW

WITH COOLING PIPING in series to all bearings (Pef's *preferred* hookup), last bearing may not get enough water although master valve is wide open, as editor points out. Parallel hookup (labeled *poor*) has separate supply and return for each bearing and though installation costs more, it is preferred. By having a valve for each bearing, you can control temperature of each.

Most pump and motor makers specify parallel supply hookup. My sketch shows a typical hookup with regulating valves near waste discharge. That allows operator to observe, control flow at same time, removing Pef's objection.

H B WAYNE *Brooklyn, N. Y.*

better operating and maintenance job

STEVE ELONKA, *Associate Editor*

Safety for welders

BECAUSE THERE ARE no safety regulations for welders, I'm offering these suggestions:

Safeguard eyes against harmful light rays and both face and eyes from particles of hot metal, by using goggles, spectacles, and helmets with colored lenses.

Color of lenses is added protection against white light or glare, prevents eye strain, allows you to see metal clearly. Colors of glass are usually blue, green or brown.

Electric welder must protect against ultraviolet rays, which could painfully burn eyes, and skin of head and face. Use a strong-fiber helmet.

Welding casts off hot slag, sparks, and globules of molten metal, so prevent fires in areas where wood is used for scaffolds, floors, etc.

If not practical to remove parts to be welded, or to move flammable material to a safe location, use a shield of asbestos to protect flammable material.

Welders must adhere to these important cardinal rules when welding flammable and explosive substances:

1.) Never attempt to weld or heat empty container previously containing a flammable or explosive substance unless all such substances and their latent fumes have been completely removed and the container itself has been well vented.

2.) Never weld closed cylinders or jackets unless such units are amply vented.

Make sure all gas and its fumes are extracted from tanks by thoroughly steaming the vessel until all traces of gas smells are gone. Flush the tank with water and fill it to overflowing with water before welding.

Another important rule for welders is good ventilation. Avoid these dangerous operations: Welding fumes of burning paint, brazing, brass, and galvanized parts. Fumes may make welder sick or knock him out.

Good ventilation is a *must* when welding. Always wear clothing that isn't torn and that fits properly. This prevents (1) clothing catching on fire (2) ray burns from arc.

If you are welding outdoors in a wet area, it's most important to stand on a wooden plank to prevent shocks and possible injuries.

These are all basic safety requirements for a welder, should be followed.

R KEMBEL *Bethlehem, Pa.*

What would you have done?

AFTER PROMISING to have the supercharger on our diesel engine in running order in half an hour, I dropped one of the mounting screws into the impeller. It would have taken an hour to open it again, so I had to think mighty fast or go back on my word.

I improvised an electromagnet of two dry cells by connecting a length of insulated wire to one pole. I wrapped several turns around a bolt, then led other end back to opposite pole on second battery. Loop with coil on end was long enough to reach down inside impeller near the screw.

All this took only a few minutes and I could get the coil close enough to the screw to draw it to the magnetized bolt. What would *you* have done?

H HOLCOMBE *Los Alamos, N. M.*

Here's what I'd do for JWB's June headache

IN FINDING a vacuum leak (POWER, June 1954, page 137).

In Aug, p 125, J R Barrett gives two methods for J W B to find vacuum leaks in a steam-turbine unit. Carbon tet is highly toxic and I would never use it. I also would not gag the atmospheric-relief rupture disk and then crack the main stop to build up 1 psi inside, as he says. As for building steam pressure in turbine without jacking engine over—well, that's out of the question.

With disk gagged, all your protection is gone, and you could never control steam through main stop to 1 psi, as he claims he did. The old chief's method of using shellac is safe—even if it does take two weeks to find the leak. We always use air of 2 to 5 psi inside condensate system, with soap suds on the outside. Or we feel around suspected leaks by hand while air pressure is on the inside.

J ELLINOR *Long Beach, Calif.*

EDITOR'S NOTE: *Carbon tet was considered a cure-all 20 years ago. But since then many firms have found it extremely dangerous, so most are against working with it. Even with a man standing by vacuum breaker, as Barrett suggests, the gagged rupture disk isn't safe.*

While drastic measures are often tried in an emergency with good results, they may not be good practice unless men doing the work are highly competent. In this case, there is no emergency. Even though Barrett says he has had success with his two methods, insurance firms do not recommend them.

How would you groove this bearing?

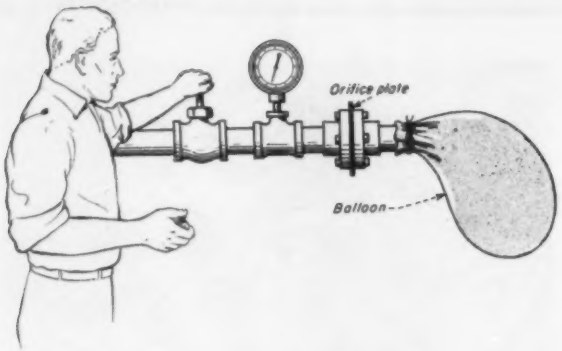
DO YOU CLAIM to know something about grooving babbitt bearings? In a steel mill a question came up about large, horizontal-joint, slow-speed drive bearings. Load on bearing reverses, and direction of load is near top horizontal joint. Gravity oil feed is from top of bearing. Because load reverses, question came up about right way to groove such bearings. Every bearing in the mill was grooved in a different way.

If you have some grooving ideas, send them in. We'll run the best ones.—Ed.

(*Continued on page* 144)

More PRACTICAL IDEAS

Begins on page 142



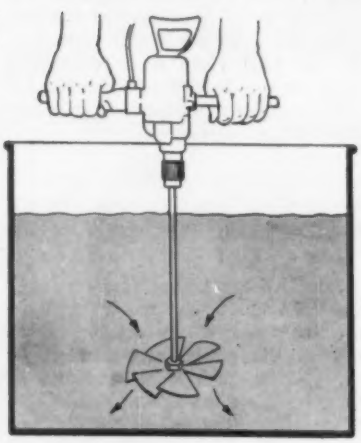
Here's your 'trick' of the month

FORMULAS for measuring quantity of air flowing through an orifice all require so-called "constant" to be selected according to nearest pressure, or pipe size, or flow, or thickness of orifice plate, or to take care of size and amount of rounding of orifice hole. All this leaves a man, who wants to get an air-measuring job done quickly and correctly, rather bewildered. Many times, it also leaves him with the wrong answer. Once when we tried to measure performance of a new air compressor, we got answers 30% low from formulas. You can get correct measurement for existing orifice and pipe arrangements very easily. Just calibrate the orifice at desired pressures, using a war-surplus balloon to measure a quantity of air for a measured length of time. Use a stop watch.

Quick-opening valve is a convenience, but good results are obtained with an ordinary valve if you open and close it rather quickly. Balloons that inflate to 9 or 11 feet in diameter are available through "surplus" stores that advertise in city newspapers. They cost less than two dollars. Because inflated pressure is scarcely more than atmospheric, orifice operates as if in free air discharge. Therefore, the calibration applies to free air discharge when you use same pipe arrangement for actual test. Balloon is inflated enough to form a sphere, which is measured by passing a string around the diameter. For greater accuracy make several measurements for average data. Volume is calculated from the formula $V = 1/6\ \pi\ D^3$, or $V = .5236D^3$, where D is diameter of balloon. This method gives answers that absolutely check volumetric displacement of compressors. You need no formulas. Calibration of pressure vs quantity can be quickly made and applied direct to problem.

H C MARCROFT *Lancaster, Pa.*

Handy paint mixer saves man-hours, sweat



MIXING PAINT, refractory cement, etc, in our plant is easier now and takes less time.

For light-duty mixing, we made an impeller of 16-gage sheet metal, 2½ in. dia. Circle is cut in six equal segments, like a pie, to within 1 in. of center hole. Blades are pitched so mixing motion drives material toward container's bottom. Shaft is ¼-in.-dia rod, threaded on one end for locking impeller between two nuts.

For heavy duty, we use ½-in. rod, 6-in.-dia impeller of ¼-in. sheet iron. Shaft is ¾-in. dia for our large electric drill, while smaller impeller is for small drill. These mixers are invaluable.

F V O'TOOLE *Davenport, Iowa*

Orsat operation tips

1. Keep a record of readings at various leads and ambients together with pertinent data, such as burner pressure, stack and furnace draft, temperature. Make it available so operator can compare past with present readings. Suspect faulty orsat when only part of readings agree, as when the O_2 reading is higher or lower than normal for a given CO_2 reading.

2. Change water daily if in constant use as it becomes contaminated by both flue gas and reagents (these usually come over in vapor form and condense in the water). Allow water to reach near ambient before using the orsat. If it's much cooler, bath and also the gas sample will change temperature during test. This also changes volume and gives false readings.

3. Be sure to get a pure, accurately measured sample. Test the sampling lines frequently for air leaks; clear the line carefully so sample tested is a current one. After trapping the sample, recheck to see that water in leveling bottle and the meniscus in the graduate are both on zero at same time. Because of refraction in bath bottle, it's important to have the eye level with zero, too.

4. When making a test, bring reagent up slowly on last pass so no gas is trapped in wire mesh of reagent bottle to give a false reading. When bubbles form in top of reagent bottle between uses, this is usually their source.

5. Test for leaks in manifold, graduate and 3-way cock by trapping gas in graduate, setting leveling bottle about a foot above orsat, and noting water level. If no change is indicated within ten minutes, these parts are tight.

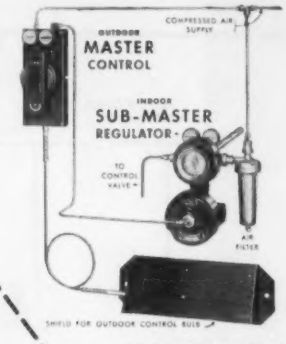
6. Test for leaks at reagent bottles and valves, one at a time, by opening valve and holding reagent level in neck by pinching hose to leveling bottle. Because of small volume here, a leak will show.

7. When changing reagents, wash tanks and bottles. Look especially for sediment in CuCl (CO reagent) tank because the copper wire often breaks up and drops out of bottle. Before replacing tanks and reagent bottles, screw valve stem completely out, check for sediment on valve disk and run an ordinary pipe cleaner through valve body. Keeping these passages clean makes for easier operation. Raise CuCl and pyrogallic acid (O_2 reagent) to normal level before connecting bladder and check here for air leaks that cause reagents to deteriorate rapidly.

H HOLCOMBE *Los Alamos, N. M.*

(Continued on page 146)

MASTROL SYSTEM for Forced Hot Water Heating



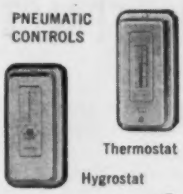
Pneumatic Switch

3-Way FLOWRITE Valve

PNEUMATIC CONTROLS

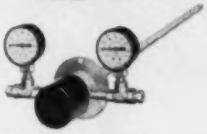
Series 100 Recording Controller and V-Port FLOWRITE Control Valve

PNEUMATIC CONTROLS



Thermostat

Hygrostat



LIMITEM Thermostat

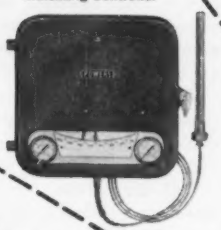
FLOWRITE Diaphragm Valve Single Seat

Convector and Unit Air Conditioner Valves

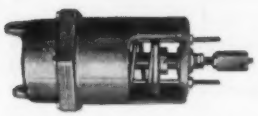
Packless Type

3" POWERSTROKE Damper Operator

Series 100 Indicating Controller



Static Pressure Controller



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POWERS

TEMPERATURE and HUMIDITY CONTROL

For Heating and Air Conditioning Systems Industrial Processes

Water Heaters • Heat Exchangers Jacket Water Cooling

All Types of Baths Hospital Hydrotherapy

Most of your control problems can be solved sucessfully with the aid of a POWERS engineer and the proper application of some of our modern products. Why not profit from our 60 years of experience? There's no obligation. Phone or write our nearest office.

(GN)

No. 11 Self Operating Temperature Regulator

Available with Single or Double Seat and 3-way Mixing Valve

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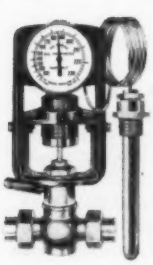
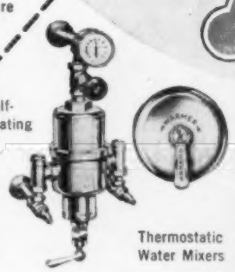
Compressed Air or Water Operated



No. 11 Temperature Indicating Regulator

Self Operating



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More PRACTICAL IDEAS

Begins on page 142

Did you know . . .

that industrial wiping paper gives you a firm grip on oily chains when hoisting heavy loads? Here Rigger George Murray of Philadelphia Electric Co, who is about to remove a stator of a synchronous motor, puts paper to good use.

Courtesy, Scott Paper Co

A metering trouble

ERRATIC PERFORMANCE of a metering installation brought to light some details of interest.

Service was 3-phase, 550-volt. Meter of 110-v rating required two potential transformers to change voltage as applied to meter. Since something seemed to be wrong with the records, we made an inspection.

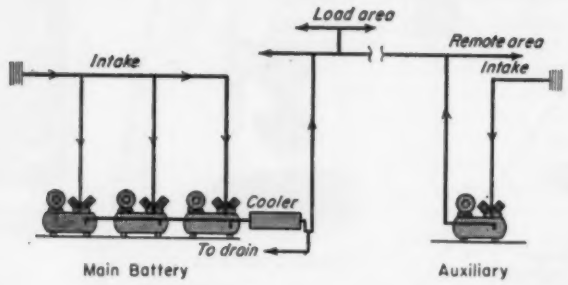
That examination brought out the following: Three fuses had been inserted in the 550-v connections to potential transformers. Fuses were mounted on slate base in holders at normal 600-v spacing. Testing showed meter was correct.

However, removing one fuse during tests indicated that coil was still energized. This odd condition, while mystifying in itself, had its cause revealed when lights were put out and we found leakage between terminals of empty fuse holder.

More tests and inspection gave us the answer. There was enough metallic content in slate base to cause condition we found. We eliminated the trouble by following practice of modern metering installations: removing fuses and base, also direct potential connection to transformers.

C O VON DANNENBERG

Brooklyn, N. Y.



Is combined central and zoned system of small compressors best?

ARTICLES ON AIR COMPRESSORS and piping recommend either central or zoned system. Our experience proves that a combination of these two systems works very well. My sketch shows how we placed bulk of our air compressors in one machine room. We found from experience they are better maintained than equipment scattered throughout building.

We also have a small air-cooled unit at a distant point on our air piping. It starts if there's a heavy load on this end of line. Small unit is set to cut in at a lower pressure than units in machine room so it runs for short periods. This unit also has a tank to give storage capacity for surges of air in this vicinity in system.

We've had better success with a bank of small compressors than with a large unit to supply bulk of air. Compressors are set to start at different pressures. Settings are changed every six months so running time is equal on all machines. This multiple compressor setup allows us to isolate units for maintenance work without interference with air supply to system.

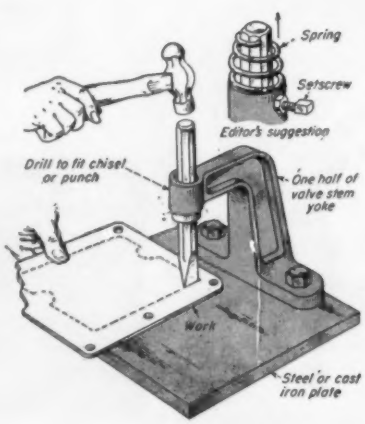
As our load increases from building expansion, we add more units. Then we don't have to invest as much as if we used larger units.

Our air intake for compressors is taken from a shaded dock area. Outside air is blown into the compressor room with a fan motor controlled by a thermostat. Then compressors and driving motor do not get too warm. A water aftercooler is used with a moisture trap leading to an open drain. Blowdown valves are connected to low points of line with blowdown run into an open drain.

D WEUM *Minneapolis, Minn.*

EDITOR'S NOTE: Dale Weum has a bright idea that is well worth giving a try.

Handy chisel holder for bench block

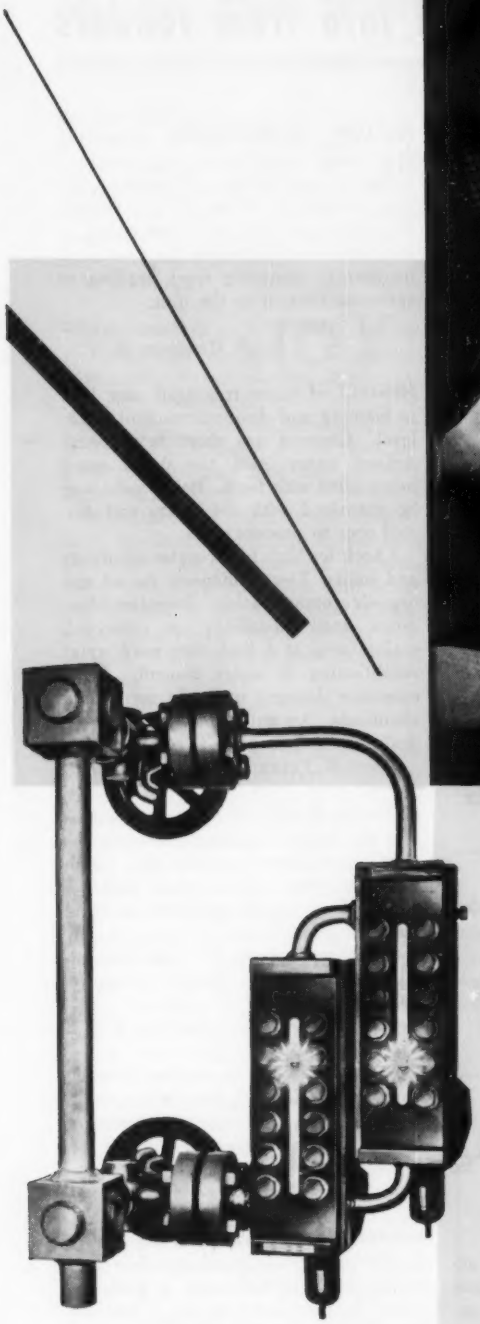


WE MADE this chisel holder for cutting gaskets and thin sheet work on bench plate. An old gate-valve stem yoke has threads drilled out to receive chisel shank. Yoke is bolted to cast-iron plate.

This device allows mechanic to use both hands, one for adjusting work and the other for hammer.

H WILLEY *Concord, N. H.*

EDITOR'S NOTE: This is a clever idea, especially since mos plants have old valve-bonnet yokes. But you can go one step further by sliding a compression spring over the chisel so it lifts the chisel up every time the chisel is hit. Just have it clear the work by ⅛ in. or so. Then place a setscrew through yoke so chisel slides, but does not turn.



Yarway High Pressure Boiler Water Gage with separated-design flat glass inserts. Write for Yarway Bulletin WG-1812

HE'S A SPECIALIST ON STAINLESS STEEL INLAYS

• A dentist? No.

He's a Yarway craftsman. In the picture above he is milling a gasket groove in the stainless steel facing that is used for this important part of a high pressure boiler water gage body.

The man is important; so is the inlay.

The man is typical of the skilled workmanship that goes into every Yarway gage, blow-off valve, steam trap or other product —workmanship that makes no compromise with quality.

The stainless steel facing is typical of advanced Yarway engineering design. That inlay is but one of twelve basic improvements made in Yarway high pressure water gages.

When buying boiler water gages as well as other steam plant equipment, measure the cost in terms of good engineering, quality, workmanship, and dependable service.

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STRAINERS
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PLANT PROBLEMS . . . *helpful info from readers*

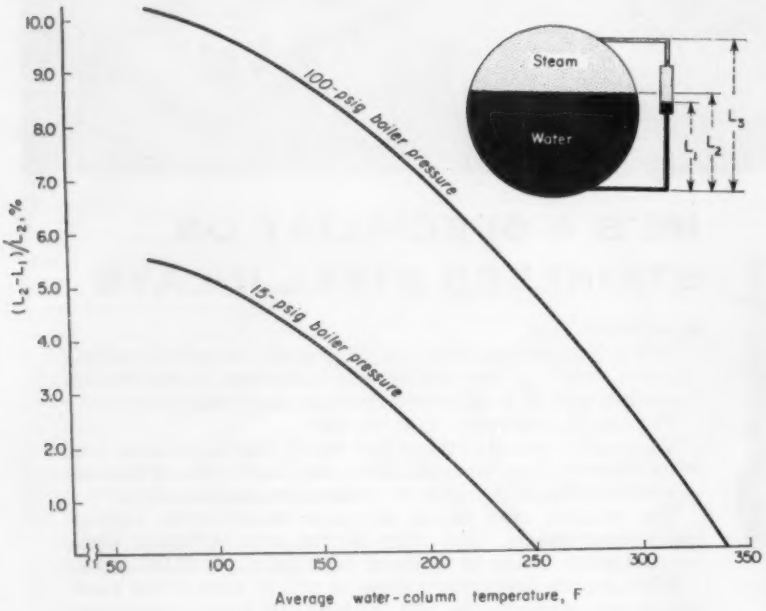
Why does water leave the gage glass?

HERE ARE THE FACTS: Our plant has a 4000-lb-per-hr oil-fired firetube boiler. Until three weeks ago it ran fine. But since then water in the gage glass drops from sight once a day. This usually happens about two hours after start-up.

We normally carry two to four inches of water in the glass. No change appears in the boiler load either before or after the water disappears. We've checked the column for dirt and thoroughly cleaned it. Draining boiler, checking feed pump and controls did not cure the trouble.

Why does water leave the gage glass? How can we prevent this condition? Is it unsafe?—*RH, Sept Power*

Here are the answers



DENSITY DIFFERENCE between water in boiler and that in gage could cause disappearance. Curves show deviation possible for two pressures—15 and 100 psig. With no circulation in column, deviation in a 100-psig boiler could be as much as 10%, or about 3½ in. Of course, this is a theoretical case, but a 2-in. drop in level is not unusual. The curves shown above are based on the steam tables.

As water-column temperature increases, the deviation from the actual water level decreases because there is less of a difference in density. Under no-load or steady-load conditions, actual water level is higher than column indicates. When the load suddenly increases, the opposite is true.

Check gage-glass location with respect to boiler shell to see it agrees with manufacturer's recommendation. The glass may be higher than it should be.

This condition is more undesirable than unsafe if the boiler has the correct safety devices. However, it should be corrected immediately, if possible.

JOSEPH SCHNEIDER
Needham, Mass.

FRICTION IN REGULATOR controlling feed pump caused water in a base-load boiler in our plant to disappear. To cure the trouble all we did was remove the valve stem and clean and polish it. Incrustation collected on the control at its normal operating level, leading to excessive friction in the unit.

W J STEINERT
Fresh Meadows, N. Y.

NEGLECT of water treatment may lead to foaming and disappearance of water level. Chances are there is no well-defined water level, the steam space being filled with foam. Boiler salts may be entrained with the steam and carried over to process units.

Check for high boiler-water alkalinity and solids. Test condensate for oil and organic contamination. Increase blowdown until instability is corrected, maintaining at a high rate until water conditioning is under control. Avoid excessive dosage; use only recognized chemicals. An anti-foam agent may be desirable in this plant.

JOHN W TYLER *Rumson, N. J.*

FEED-LINE SCALE can reduce water flow into the boiler. Replace line with the next larger size to prevent this condition recurring. Have water analyzed and apply a suitable treatment to avoid future scale build-up.

Check feed pump for wear that reduces its capacity. Repair pump or install a larger one.

G E PARK *Rumson, N. J.*

CHECK PIPE SIZE of connection between boiler and column. It may be too small. An open gage cock may cause pressure inequalities or a siphoning effect.

SHELDON HIGGINS
Long Beach, Calif.

HIGHER WATER LEVEL than the 2 to 4 in. *RH* mentions is necessary when load is heavy. Check automatic controls for wear. Inspect boiler to see it has not settled at the rear. See that piping runs between boiler and water column are level and free of obstructions.

ART BELTON *Montreal, Canada*

CONTAMINATION from fuel-oil heater or process coil can cause water to leave gage. Analyze condensate being returned to boiler and apply suitable treatment, if needed.

HENRY RASMUSSEN
Crystal Lake, Ill.

on gage-glass water and raising motor speed

TYLER HICKS, *Associate Editor*

WATER TRAPPED in column steam connection caused level to disappear in one plant. Drain hole in line to column was plugged with scale, preventing drainage of condensate. Removal of pipe so steam had free access to column cured the trouble in this plant.

W R PENDER *New Orleans, La.*

STEAM DEMAND may reach a maximum at time water disappears. Feedwater flow must equal the sum of steam output and blowdown, if water level is to remain nearly constant. Recording-type flowmeters on steam and feed lines are good for checking flow into and out of the boiler.

If charts show steam output exceeds feed, regulators and pumps should both be checked for capacity and performance. Operating the boiler with water out of sight is unsafe because it indicates some of the tubes are not submerged. Tube failures are possible if this condition exists.

H B WAYNE *Brooklyn, N. Y.*

WATER LEVEL tends to rise as firing rate increases. This results from the larger number of steam bubbles in the boiler water. Momentary rise in level may cause an automatically controlled feed pump to shut down. Water level drops sharply, because more water is being evaporated than normally, and the feed pump cannot meet the demand.

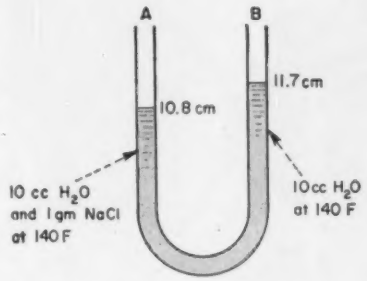
To minimize water-level fluctuations in our plants, we use master pressure-reducing valves on every main header to keep boiler pressure at least 25 psi higher than reduced downstream pressure. This reduces the effects of steam spurts that siphon water from drum.

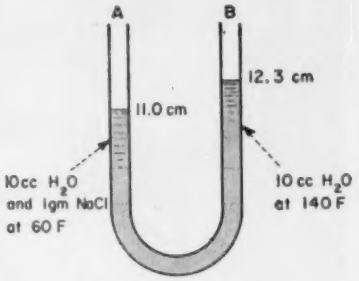
Stop fuel and air supplies as soon as water disappears from sight. Do not alter feed supply, open safety valve or make any adjustments that might change the stresses to which the boiler is being subjected.

L W FITZPATRICK
Jefferson City, Mo.

THERMAL-TYPE feedwater regulator will allow level to disappear if it cools after the water column is blown down. Remedy by installing a valve between column and generator blowdowns. About once a week, when boiler can be closely supervised, blow down while generator is hot. Remember, a cool draft can reduce generator temperature enough to produce a change in water level.

HOWARD HOLCOMBE
Los Alamos, N. M.





COLUMN LEAK that allows a small amount of steam to escape can cause a buildup of impurities and chemicals in the gage glass. This increases the density of water in the column to a point where it exceeds that in shell. An unlagged column can produce the same effect, but here the density difference is traceable to the temperature difference between water in the shell and the column.

Lag column if it is now unprotected. Blow down more often to rid column of the higher-density water. Check a sample of column water for impurities and if present, locate and plug leaks.

Sketches show two experiments I ran to find the effect of a salt solution on column-water level. In each, *A* represents the water column, *B* the shell. Note in both sketches that the salted solution indicates a lower level than in the shell, the difference in levels increasing with temperature difference.

A low gage-glass level is not unsafe if due to these conditions and if the shell level is correct. But for convenience, remedy the trouble.

JOHN P MANN
2nd Class Engrg Midshipman
California Maritime Academy
Vallejo, Calif.

For your two new problems, turn to page 152

ACID CLEANING helped in a similar problem, but did not cure it entirely. Further study showed Hartford loop was plugged with dirt and rust, preventing free condensate return to boiler.

EDWARD GRIEF *Bogota, N. J.*

CHECK FEED PUMP and all openings in feed system for scaling. See that pump and controls operate correctly and are not excessively worn.

C G HOWARTER *Canton, Ill.*

(*Continued on page* 150)

Who answers Plant Problems?

Our reader surveys and mail regularly show Plant Problems to be one of *Power's* most popular departments. Questions, and answers, come from all parts of the world. So it isn't unusual to find a man on the island of Cyprus, in the Mediterranean, advising a man in Montana about the solution of some knotty problem that keeps him up nights.

Ever notice, as I have, that there's a group of readers who answer more or less regularly? Names, like Fitzpatrick, Breugelmans, Wayne, Howarter and Evans, are probably familiar to you if you're a regular reader.

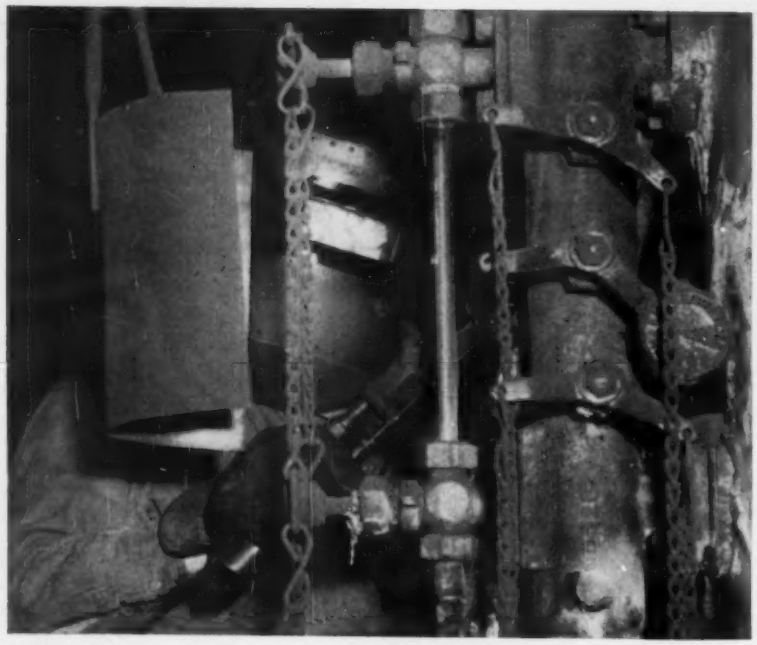
So when Don Cochrane, Cambridge, Minn., suggested we run short career sketches of some of our regular contributors, we said, "Fine! Send us yours first."

Starting next month you'll learn more about these men, why they answer Plant Problems, and what this department has done for them. We'll take you right into their plants and show you how they acquired the background for their excellent answers. We know you'll enjoy meeting this fine bunch of men.

—Ty Hicks

More PLANT PROBLEMS

Begins on page 148



FOR SAFETY, protect your hands and face when working on boiler water column, gage

Gage-glass water problem

(*Continued from page* 149)

CONDITION IS DANGEROUS and sooner or later will seriously damage boiler. Fit a low-water cutout immediately if boiler is not equipped with one.

Restricted feed line or faulty feed pump are possible causes. Check water-column connections to boiler and gage-glass valves for obstructions. Foaming or priming, resulting from contamination by leaks in process units, can cause water loss. Analyze return water to find if it is contaminated.

Other possible causes include a leaky blowoff valve or feed check valve.

F R HAWORTH *Arlington, Mass.*

IMPURITIES ACCUMULATE during boiler banking and cause foaming. Check for fuel-pump oil leaks, condensate contamination and flue-gas leakage through a joint during start up. Analyze water to find which dissolved salts must be removed from it to cure trouble.

A J BREUGELMANS *New York, N.Y.*

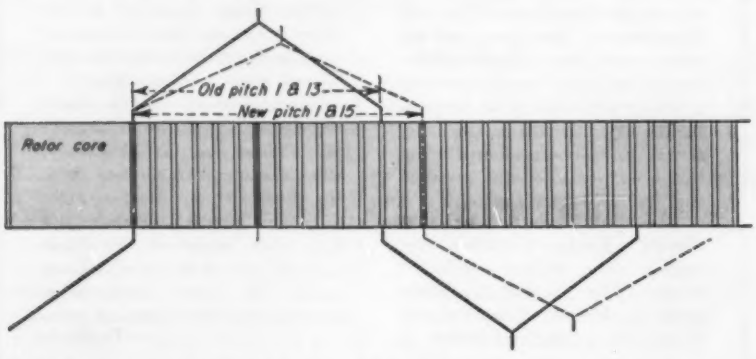
For your two new problems, turn to page 152

How can we raise motor speed?

HERE ARE THE FACTS: We have a 12-pole 440-v 600-hp slip-ring motor, driving a hoist. We'd like to increase the motor speed slightly, say 20%. I have figured a way to change the stator connection from 12 to 10 poles by leaving only a few dead coils evenly spaced around the stator. Must the rotor connection be changed to 10 coils as well?

If the rotor has a wave winding, can we do this by changing the rotor connections and using the same windings? Is it absolutely necessary for the rotor of this type motor to be wound for exactly the same number of poles as the stator?—*BB, Sept Power*

Here are the answers



WALSH *(right)* says *BB* can use same winding if he reconnects right for new speed

FOR SATISFACTORY OPERATION, rotor winding must have same number of poles and phase groups as the stator winding. Rotor connections can remain as they are if number of poles stays the same and voltage, phase or frequency of primary winding is changed.

Rotor windings must match stator windings for satisfactory starting. Secondary resistance must be designed to fit rotor characteristics. A simpler solution to this problem is to consider the advisability of changing gears now in use. Desired step-up is easily obtained.

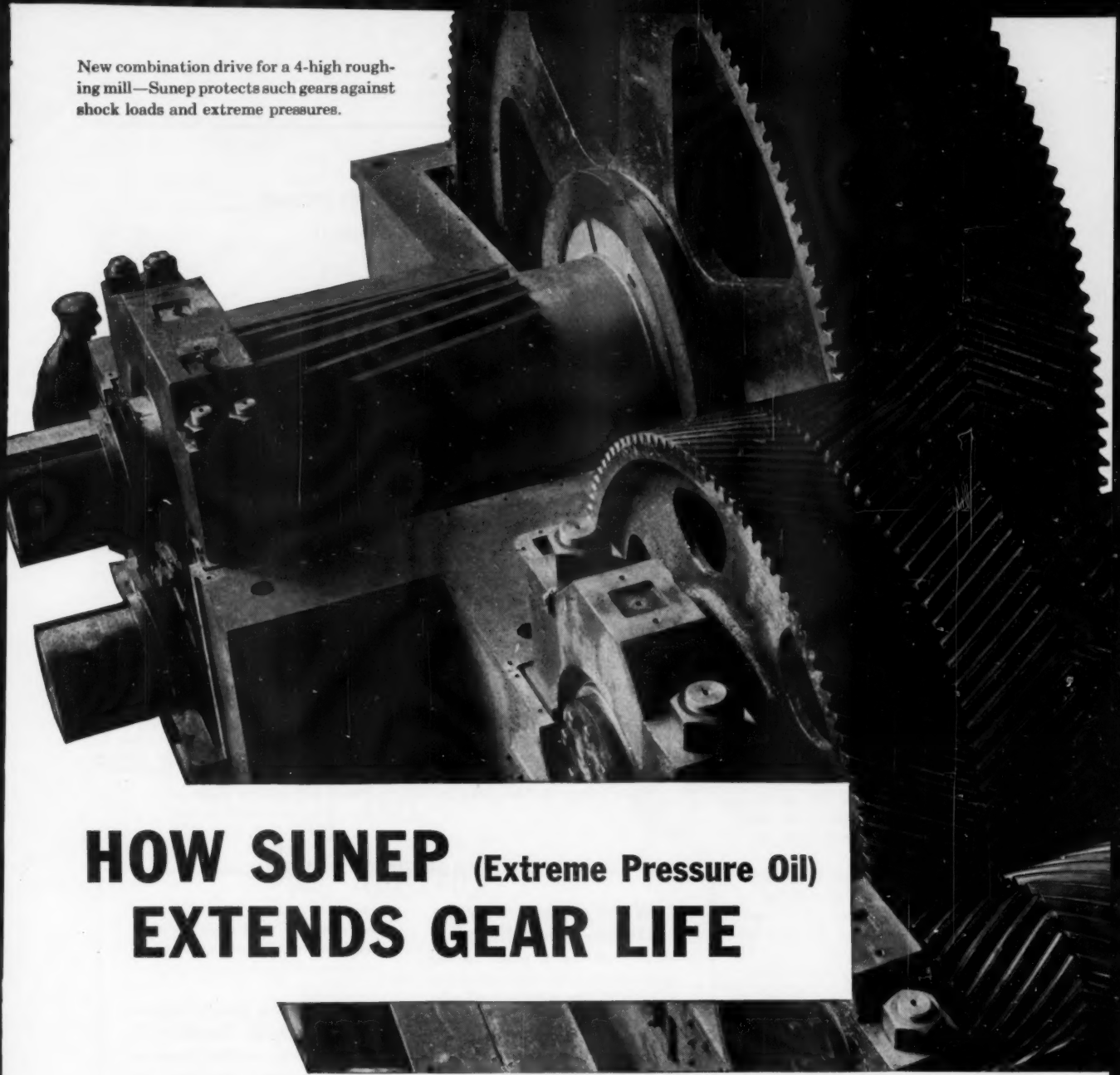
L W FITZPATRICK
Jefferson City, Mo.

CHANGING THE SPEED of an existing motor is not always as easy as it sounds. But if the winding has not already been changed, the speed range *BB* desires is possible. The same winding can be used if it is reconnected.

Changing from 12 to 10 poles will raise motor speed from 600 to 720 rpm. In turn, this calls for an increase in voltage. But dead coils left out of circuit compensate for voltage increase.

Sketch shows how winding can be changed to give the higher speed. It is based on the assumption that the rotor contains 144 coils. A rewinding job of this type is best done by a shop.

N S WALSH *Montreal, Canada*



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Primarily a lubricant for enclosed gears, Sunep has proven to be highly effective on bearings and screws working under extreme pressures. Because of its exceptional clinging characteristics, Sunep guards against metal-to-metal contact during the early moments of machine operation after shutdown. FREE BULLETIN. Tells all about Sunep. Get your copy. Write Dept. P-12.

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Refiners of famous High-Test Blue Sunoco Gasoline

More PLANT PROBLEMS

Begins on page 148

SERIES-CONNECTED conductors that do not generate opposing voltages are all that are needed for the rotor winding. Number of phases for the rotor need not be the same as for the stator.

C O VON DANNENBERG *Brooklyn, N. Y.*

MECHANICAL speed increaser of some sort is better than increase of motor speed. But if *BB* prefers raising motor speed, I suggest he consider reconnecting the stator for a 2:1 speed ratio. By variation of the secondary resistor he can still obtain economical adjustable-speed operation without disturbing the rotor connection. Effect on horsepower and torque must be studied.

Changing from 12 to 10 poles might cause so many difficulties that it would be better to replace the motor. Check with motor manufacturer before attempting major changes in the motor.

CARL BACHMANN *Rego Park, N. Y.*

REGROUP COILS in stator so each has the same voltage across it as originally. Pole groups must be reconnected without leaving any out. It may be impossible to do this. On a motor of this size where mechanical connections cannot be rearranged to change the speed, a new motor would probably be best.

E A ROBERTS *Carlsbad, N. M.*

OLD WINDINGS should not be used for this job. It is far more economical to rewind the stator for the speed increase. Coils per group must be changed because the number of poles is being changed. Reconnect coil leads to change the coils per group.

With a 20% increase in speed, voltage rises by same amount to 528 v. Some change must be made in the connections, if the motor is to operate at 440 v. With an original series-delta windings, changing to two-parallel-star windings reduces required voltage to 457 v. Considering the effect of coil span on voltage, this value is about right for a 10-pole connection.

The motor may vibrate at the higher speed, but the rotor can be easily balanced to control this condition.

F R HAWORTH *Arlington, Mass.*

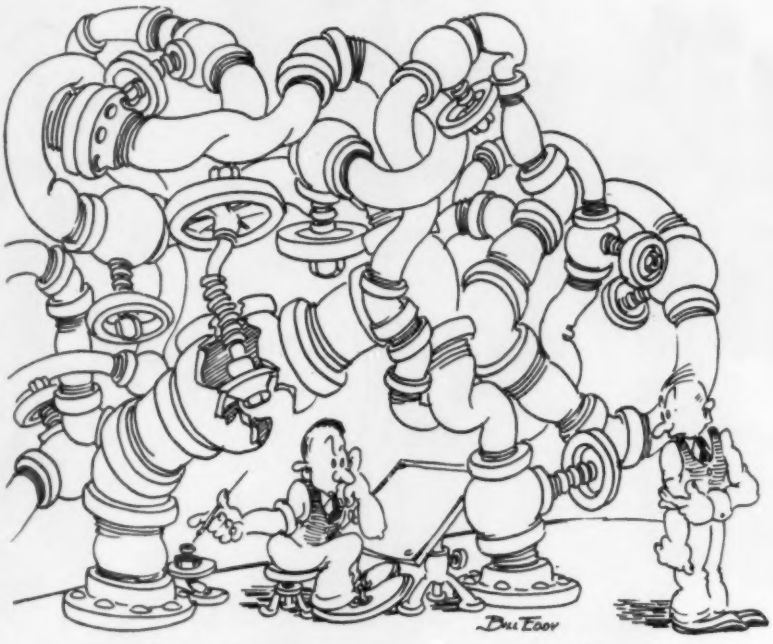
CHECK LOAD PER PHASE. If amperes-per-phase on stator windings is about the same, rotor can be used as is. Exact values can be obtained from a winding data book. For an operating check use tong-type meters.

C G HOWARTER *Canton, Ill.*

(*Continued on page 216*)

No. 11 of the Bill Eddy cartoons

Repeated by request



"Let's forget it, Mac, and go out and have a bowl of spaghetti."

YOUR TWO DECEMBER PROBLEMS

1 What's best way to steam-trace lines?

We're building a plant in the colder part of Canada and we're faced with the problem of adequately protecting long runs of outdoor fuel-oil, chemical, water, air and process piping. We want to avoid the dangers of freezing a line and we'd like to keep power input to pumps and compressors low.

Steam will be available for tracing these lines, but right now we're wondering what is the best way of tracing lines like those listed above. Run between power plant and other buildings varies from a few hundred feet to about one mile.

Which is best—prefabricated pipe containing built-in traces, or regular pipe with an extra line for tracing? How is condensate from trace handled? Is there any relation between trace-line size and pipe size? Is electricity more practical than steam for tracing?—*GT*

2 What are good blow-down-tank layouts?

We have three 100,000-lb-per-hr boilers to which we must fit blowdown tanks to protect a new sewer from flash. Our local laws do not have any specific requirements for tank design other than that it be suitable for conditions in the plant.

These boilers operate at 900 psig, 750 F. There is enough room behind each boiler for installing a tank.

What is best hookup for this type installation? Should a single tank be used or are three better, one for each boiler? What are good pipe layouts for tanks? Can heat be recovered?—*MS*

Will you help readers who sent problems? Extra pay for photos, sketches.

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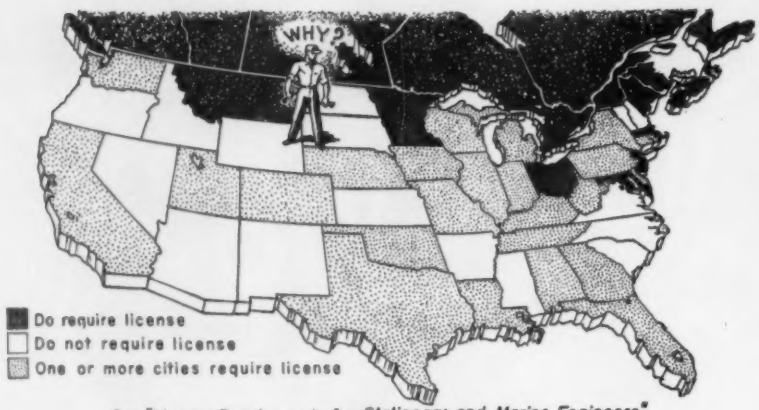
CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

ARGUMENTS

Here's the place to unload your gripes to editors, manufacturers and fellow engineers



See "License Requirements for Stationary and Marine Engineers" Feb '50 Operating Engineer

Why such different license requirements?

IN AUGUST ISSUE I noted one combination that doesn't rhyme in any language: D C Swift's article on "Boiler Starting," p 92, states that any unit, 15 psi or over, must have at least one properly licensed operator in attendance at all times. Yet C Tretinyak says, p 125, "after standing unattended all night, boiler with low water had about 40-psi steam; boiler with high water had about 50-psi steam."

My first conscious act after emergency safety measures would be to make an immediate report to the licensing authority having jurisdiction in the area. In this backward Land of Maples we are half a century ahead of you, with practically uniform regulations in all provinces; and these rules are enforced.

This puts a good, hefty premium value on a Canadian engineer's license. If I allowed conditions described by Tretinyak, both his and my tickets would be canceled as soon as authorities found out.

The tendency for plant owners to save shekels by taking such chances on the safety of plant and lives has been completely checked up here in Canada by giving the law a real set of teeth and strengthening its jaw muscles.

BERT RICHARDS *Toronto, Canada*

EDITOR'S NOTE: *According to "License Requirements for Stationary Engineers," Operating Engineer, Feb 1950, only seven states and the District of Columbia license stationary engineers. See map above. In 25 other states, some communities issue licenses. Sixteen states require no license at all. Yet in Canada, a license is necessary in every province except Newfoundland and Prince Edward Island. What can be done about the discrepancies?*

Presents formula for engineering progress

THE CHIEF TROUBLE I find with men whose training is all in the shop is that they often waste a lot of time in "cut and try" to produce a new design. After all, avoiding this may be a major reason for having engineers around.

On the other hand, the man with the watercooled slide rule is liable to be a menace to public safety around machines. One extremist wanted to lay a large transformer on its side, and could not see why it mattered as "a transformer has no working parts."

In a less rarefied stratum, the young man with a BE degree, who draws parts on his board without the faintest idea how they are to be produced and "is too damn well-educated to come down and find out," as one old shop superintendent put it, wastes a lot of time and money.

But generally the graduate picks up enough practical knowledge, and the practical man enough theoretical so they can cooperate with each other.

Engineering will never advance very fast without the theoretical approach, but the practical man must keep the theoretician's feet on the ground. Both types of engineers are needed.

PAUL HOBSON *State College, Pa.*

Fancy breeding makes engineers? Phooey!

THAT PEDANTIC DIATRIBE of James Cates (August *Arguments*) was below your usual high standards. It reminds me of the "professional, college-bred engineer" who gave me a bad time about opening a high-pressure steam valve, until it came out that he had never opened one himself.

Cates' argument deserves rebuttal only because the views are shared so widely by the uninitiated, especially in areas where licenses are not recognized.

As someone has said, the boys who are afraid to get their hands dirty usually make good clerks. I wonder if friend Cates would be surprised to know how many practical engineers are conversant with the works of Keenan and Keyes, Marks, Kent, etc, are facile with a slide rule, and have even waded through his adolescent observations without the aid of a dictionary?

H HOLCOMBE *Los Alamos, N. M.*

Installing orifice is an old trick

INSTALLING ORIFICE in the line to restrict air flow from master control to oil governor valve, thus slowing governor valve operation and eliminating excessive smoking (p 130, July POWER) is an old trick. I believe the trouble developed because of inadequate and not too frequent cleaning of fire and water sides, plus inadequate cycle for blowing tubes, all leading to a dirty boiler and stack.

One of the basic rules of any control system is that "oil flow follows air flow." It seems that Thorpe reversed this rule with apparent success.

I would propose a better solution to his problem: completely check both air flow controls and oil governor valve. Then check master controller. This should show why air controls were lagging. Recalibrate system if necessary.

J E SCHIRMER *U. S. Navy*

Is this best way to close paint can?

DRIVE ONE OR TWO HOLES into groove of paint can, so excess paint drains back inside, instead of clogging up the groove. You will have no bother with messy rags, and can will close tightly. Paint will dry over the holes if lid does not cover them, giving an airtight seal.

L R GREIF *New York, N. Y.*

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Fast, Trouble-free Condensate Drainage
THE ARMSTRONG HIGH CAPACITY DRAINAGE TRAPS
Big air vent for fast heat-up
Hardened chrome steel valve and seat—for long, long life
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1 Wire-brush or abrasive-blast to remove deposits from corroded areas

2 Check lubrication-groove depth since the groove gets shallow as body wears

3 Tightness depends on taper, so check taper, as here, with thin feeler-stock

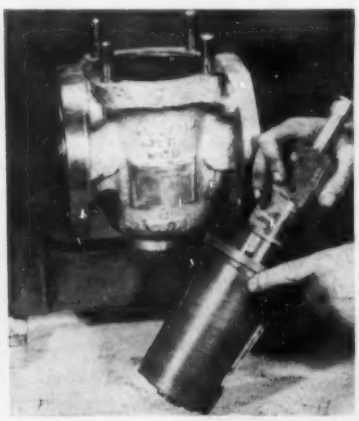
PLUG-TYPE VALVE is used as shutoff valve on water-supply line. These lubricated valves are sturdy, need little attention. Keep them tight; follow the instructions

HOW TO repair your plug-type valves

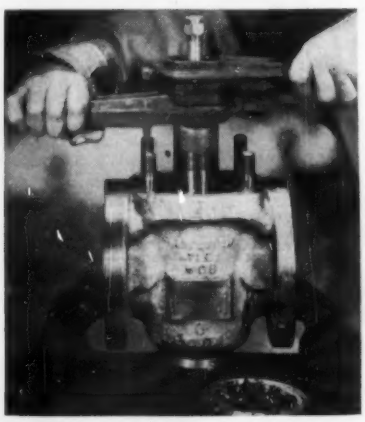
► PLUG-TYPE LUBRICATED VALVES are sturdy, with positive shutoff. To keep tight, only cleaning, inspection and reassembly with new packing and gaskets are usually needed. Clean valve with alkaline or solvent solution. On plugs having integral shanks, examine machined-shank diameter and adjacent shoulder after checking plug and seat for tightness. At times, re-lap lightly to eliminate scaly deposits and scoring or pitting. If badly worn, you may have to re-bore and fit an oversize plug. Or build up plug's surface with weld metal, then turn tapered plug in lathe and lap in. Replacement plugs are furnished oversize with a semi-finished taper to allow metal stock for fitting to re-bored bodies for this valve.

Courtesy, Rockwell Valves, Inc

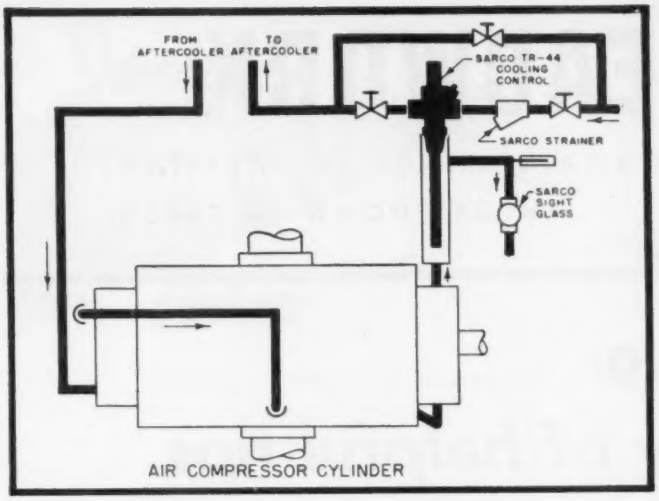
4 Apply lapping compound to the bearing surface of plug and lap into body



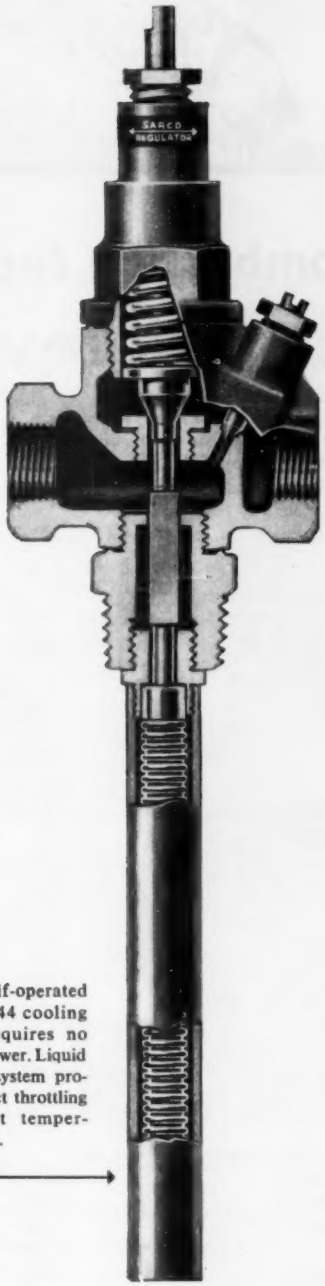
5 Clean plug and body, blue lightly, turn once or twice in the valve body



6 If blue shows valve is not tight, lap it in again until it's perfectly tight



Sarco Cooling Control guards against dangerous over and under cooling.



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YOU have to keep your eye on a lot of things to get top efficiency from compressed air systems – and one of the most important is *cooling.*

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It's a lot easier – and also safer and more economical – to let dependable Sarco self-operated temperature controls take over. They insure optimum cooling effect with minimum water consumption regardless of load variation, changes in pressure and temperature of water supply. *You get protection for compressors with maximum efficiency at minimum cost.*

Send for Bulletin No. 520-A "Is Your Air Compressor Capacity Effective?" Sarco Company, Inc., Empire State Building, New York 1, N. Y. Representatives in principal cities.

Simple, self-operated Sarco TR-44 cooling control requires no auxiliary power. Liquid expansion system provides perfect throttling throughout temperature range.

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HEADWORK

PHIL SWAIN BRINGS ENGINEERING THEORY DOWN TO EARTH

Combustion facts—10:

A quick review of helpful tips

► To WIND UP this series on combustion, I have gone over the previous nine installments and picked out this assortment of handy combustion facts.

First, here are the elements of chief concern in combustion:

Combustion elements

Element	*Symbol*	*Atomic weight*	*Gas molecule*	*Mole weight*
Hydrogen	H	1	H_2	2
Carbon	C	12	—	—
Nitrogen	N	14	N_2	28
Oxygen	O	16	O_2	32

The only important *combustible* elements are carbon and hydrogen. These may appear separately or combined (as in fuel oil or natural gas).

In any case, the hydrogen always burns to water (H_2O) and the carbon usually to CO_2. By weight, one part hydrogen combines with eight of oxygen to make nine of water. And one part carbon combines with 2.67 parts oxygen to make 3.67 parts CO_2.

Hydrogen is by far the lightest of all gases, running 188 cu ft per lb. All density figures in this article are for the standard conditions of 14.7 psi absolute pressure and 60 F temperature.

Gas volume, cu ft per lb

Hydrogen	188.00
Oxygen	11.85
Nitrogen	13.48
Air	13.10
CO_2	8.58
Methane	23.62

(chief constituent of natural gas)

Air composition

	By Volume	*By weight*
Oxygen	21.0%	23.2%
Nitrogen	79.0%	76.8%

The atmosphere is composed of oxygen, which can support combustion, and of nitrogen, which is inert. The nitrogen takes no chemical part in combustion —just "goes along for the ride."

The gas laws

If pressure, volume and temperature of any gas are known for an existing condition, and if any two are assumed for a new condition, the third can be figured from the following gas laws: *In every case, pressure must be measured in psi absolute* (*gage plus 14.7*) *and temperature in degrees absolute* (*Fahrenheit plus 460*).

Volumes can be measured in cubic feet or in any other unit.

If pressure stays constant, the volume will be proportional to the absolute temperature.

If volume stays constant (as in a sealed tank) the absolute pressure will be proportional to the absolute temperature.

If temperature stays constant, the pressure and volume will vary in inverse proportion. That is, if you double one, the other is cut in half.

If all three change, you can figure the unknown by algebra from the following equation. Five of the six items must be known. Then solve for the unknown.

$$p_1\ v_1\ t_2 = p_2\ v_2\ t_1$$

Here p_1, v_1 and t_1 refer to the initial pressure, volume and temperature, while p_2, v_2 and t_2 refer to final conditions.

This equation is easy to work with if you go at it systematically and use a slide rule. For example:

Given conditions

	Initial	*Final*
Pressure (psi abs)	86	P_2 (unknown)
Volume (cu ft)	2200	1300
Temperature (F abs)	540	860

Then, from the equation, we write:

$$86 \times 2200 \times 860 = P_2 \times 1300 \times 540$$

$$P_2 = \frac{86 \times 2200 \times 860}{1300 \times 540} = 232 \text{ psi abs}$$

Data on hydrogen, carbon

Here are significant facts about the two important combustible elements of all fuels.

	Hydrogen	*Carbon*
Btu per lb	61,100	14,093
Btu per cu ft	325	—
Lb air per lb	34.3	11.45
Cu ft air per lb	451	150
Cu ft air per cu ft	2.38	—

Air for Combustion

To figure the theoretical air required for combustion allow 0.73 lb air per thousand Btu heat in fuel: This figure is fairly close for all grades of coal and oil.

CO_2 for excess air

Following table gives the maximum possible CO_2, assuming no excess air:

CO_2 for no excess air

Bituminous coal	18.5%
Fuel oil	15.0%
Methane	12.0%

% heat loss: dry flue gas

Coal:	0.33 x temp rise ÷ CO_2%
Oil:	0.27 x temp rise ÷ CO_2%
Nat. gas:	0.22 x temp rise ÷ CO_2%

Problem: Fuel oil. CO_2, 12%. Flue temp, 550 F
Room temp, 80 F. Find loss
Solution: Temp rise =
550 — 80 = 470 deg
Loss = 0.27 x 470 ÷ 12 = 10.6%

In this last issue of 1954, we wind up the Combustion series as well as the Headwork Department, which has been running several years. I hope all of you have found something useful in these pages.—*Phil Swain, Consulting Editor*

Tested patterns to meet today's needs . . .

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in higher pressure

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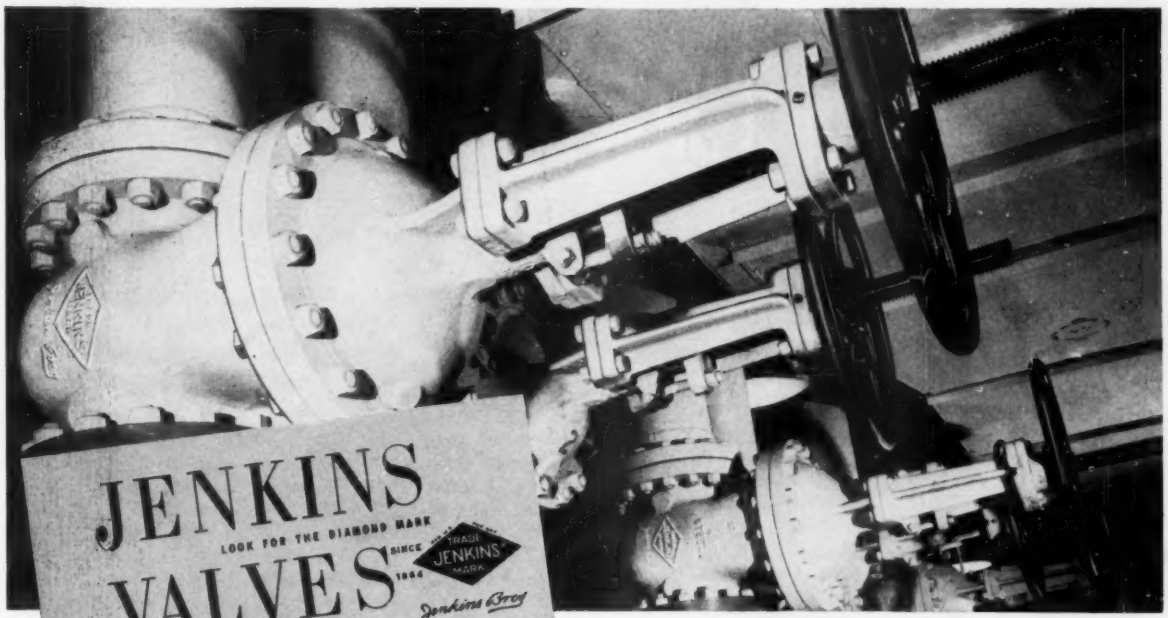

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"Why you go ahead when ol' man give order to go astern?" yelled the Chief flying down the ladder

Marmy puts her astern

► "BILGEWATER ON CHIEF ENGINEER COLIN GLENCANNON of Inchcliff Castle," roared Marmaduke Surfaceblow, consulting engineer extraordinary, when I called at his dingy office above O'Houlihan's Machine Shop & Engine Works recently. This outburst took place when I told the cantankerous old gent about a letter sent in by Professor K A Kobe, Dept of Chemistry, University of Texas.

The good professor wrote, "I'll certainly keep up with POWER so long as Surfaceblow continues to sound off. Did he ever run up against Glencannon? What a story that would make."

I knew Marmy was in because the No. 6 Ringelmann smoke from his cigar had me coughing before I entered his office. There he was, busy with paper work at his ancient roll-top desk. With shirt sleeves rolled up, he was busy puffing and sketching what looked like a "corn-squeezins" still I once saw in the Kentucky mountains.

"Sure, I've run into Glencannon," continued Marmy, shoving his papers to one side, "but now I'll tell you about the time we almost lost a ship because some paper jack was too lazy to spend 15 minutes double-checking a rush order." Disappointed that this wouldn't be about Glencannon, I though I'd better not press my luck. So I took down what he did have to say. Here's Marmy's story.

"Back in 1924, I ran afoul of a kris-swinging Moro in Zamboango, Philippine Islands. Next day I woke up in the local sick bay with 40 stiches in my hull. I understand they buried the Moro. But the toughest break was my ship shoving off for Bombay without me. The Dollar Line's agent was to keep me in chow and flop until his next ship made port, but that wouldn't be for another ten weeks.

"About the time I was out of dry dock and able to navigate again, a small island-hopping diesel ship made port. She was the MS *Milagros,* registered out of Manila, and flying the Philippine flag. The Dollar Line's agent told me she needed a First Assistant Engineer for one trip. That would get me back before the next Dollar ship made port on her way to the states. I signed on and we headed north, loading copra, mahogany and other cargo on our way to Manila.

"Her main engine was an American-built 1000-hp, 2-cycle diesel. It was a

(*Continued on page* 206)

Forest of Facts on Nalco® RECIRCULATING WATER TREATMENT

NALCO Laboratories' continuous research program has gathered this forest of facts about protecting recirculating water systems. In the search for the most effective *and economical* formula, the metal rods shown have been rotated in all types of recirculating waters and treating chemicals. Results pointed the way to a group of Nalco Treatments which assure users against scale and corrosion in virtually any recirculating waters. For details on Nalco Treatment to fit your particular system, call your Nalco Representative, or write direct.

Test rod from water treated with the Nalco 82 Method shows protective film and freedom from any scaling or corrosive attack.

THE Nalco 82 METHOD MAY BE THE ANSWER FOR YOU

The Nalco 82 Method is particularly suitable for scale and corrosion control in recirculating water systems which fall within the characteristic limits given here. Check them to see if your system should have Nalco 82 Treatment:

- Equipment to be protected contains steel and/or brass.
- Hardness of makeup water is more than 50 ppm; and sulphates and chlorides, as sodium salts, are less than 150 ppm.
- Calcium hardness of makeup can be as much as 500 ppm.
- Silica content of makeup water up to 50 ppm.
- Total alkalinity of makeup more than 40 ppm.
- Recirculation rates between 100 and 100,000 g.p.m.
- Where non-toxic waste water is required.

Act today to get the certain, low-cost protection of The Nalco System. Full data on Nalco 82 in free Bulletin 68.

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FOUR REASONS WHY G-E SYNCHRONOUS MOTORS

1. STRONG, FABRICATED FRAMES . . .

The welded steel-plate stator frame provides maximum rigidity in a comparatively lightweight construction. The sturdy channel-shaped frame consists of a wrapper plate firmly secured by continuous welds to rigid side plates. This design, proved by years of operating experience, affords more than ample strength for clamping and supporting the stator core.

2. G-E BRUSHES ON G-E MOTORS . . .

Brushes on G-E synchronous motors are a product of G-E teamwork. Close co-operation between machine designers and laboratory engineers means you get the right brush on the right motor for your particular application. In addition to extensive research and testing, all new and improved grades of brushes are thoroughly field-tested before approved for standard use.

Dependable G-E Synchronous Motors on 24-Hour Assembly-line Service

Ford Motor Company uses G-E synchronous motors for air-compressor drives

Compressor-motor dependability is really put to test on 'round-the-clock service at Ford Motor Company's Rouge plant. Compressed air is used 24 hours a day on many assembly operations, and a dependable supply is vital to keep production lines moving.

To furnish this all-important air, five 2000-hp G-E synchronous motors drive reciprocating compressors continuously—with only slight reductions in demand on certain shifts.

G-E synchronous motors can be relied upon for such continuous service with minimum downtime. You can depend on them because in back of every G-E synchronous motor stand more than half a century of motor engineering leadership . . . superior research and testing facilities to assure excellent component materials . . . and a corps of experienced craftsmen who are proud of the equipment they build—and build it to last.

The next time you consider a drive for heavy, continuous-service equipment be sure to call in your G-E representative to discuss any special application problem you may have. Have him explain the many money-saving uses for G-E synchronous motors and point out their operating economies.

In the meantime, you can obtain more information on G-E synchronous motors by writing for bulletin GEA-5332, "Low-speed Synchronous Motors." Write to Section 770-29, General Electric Co., Schenectady 5, N. Y.

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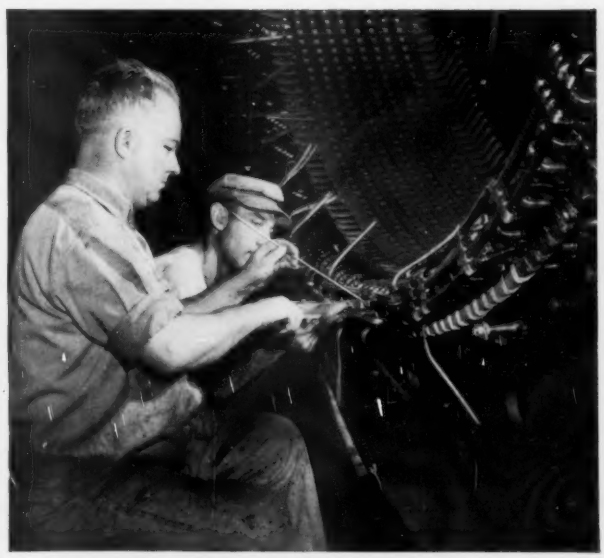
Insulating materials, manufactured in our own factories by the most modern methods, conform to rigid G-E specifications and are applied by experienced operators, above. Thus coils are uniform, interchangeable, mechanically rugged, and moisture resisting.



4. LOW-RESISTANCE CONNECTIONS . . .

For dependable operation, stator windings are silver brazed, as shown above. Joints of this type have low electrical resistance, exceptional thermal and mechanical strength. These important properties are difficult to obtain by other methods.

Speaking of power

personal slants on doings of interest to power men—some significant, some just odd

Atom power in homes may be a reality in 1956 for customers of Chicago's Commonwealth Edison Co. Before you jump to any conclusions about a "new era" let's explain that only a token amount is involved in the proposal made by the Atomic Energy Commission. It would come from the 5000-kw boiling-water reactor being built at Argonne National Laboratory, operated by University of Chicago.

Power takes over so many jobs formerly done by human muscle that it requires something out of the ordinary to get a lifted eyebrow. Mine went all the way up at the latest example, however – the good old revolving door. No longer can you play the game of letting the other fellow do the pushing. Now, with motor-driven doors on the market, nobody pushes.

Mobile power plants aren't new, but they may be in the news more often now that General Motors has unveiled five standardized units – two for highways, three for rails. To handle emergency loads and do temporary "beefing up" jobs at the end of transmission lines, they're produced by GM's Electromotive Division. Many major components are interchangeable with those of diesel locos.

Units can be started, synchronized and loaded by wire or radio impulse from a remote point. Biggest of the five models, a 1000-kw job, sells for $90,000. That $90 per kw looks mighty good in any league.

You would be wrong if you agreed with the common idea that undeveloped areas supply most of the world's industrial raw materials. "'Taint so," says Stacy May, economic advisor to International Basic Economy Corp. For proof, he cites 1950. In that year, industrial areas of North America, Western Europe, Japan and Australia produced more than two-thirds of the free-world supply.

100-million-kw mark was passed by U.S. utility industry in late October. The push that took capacity over this record level came from the startup of the fourth unit at Detroit Edison Co's St. Clair power plant.

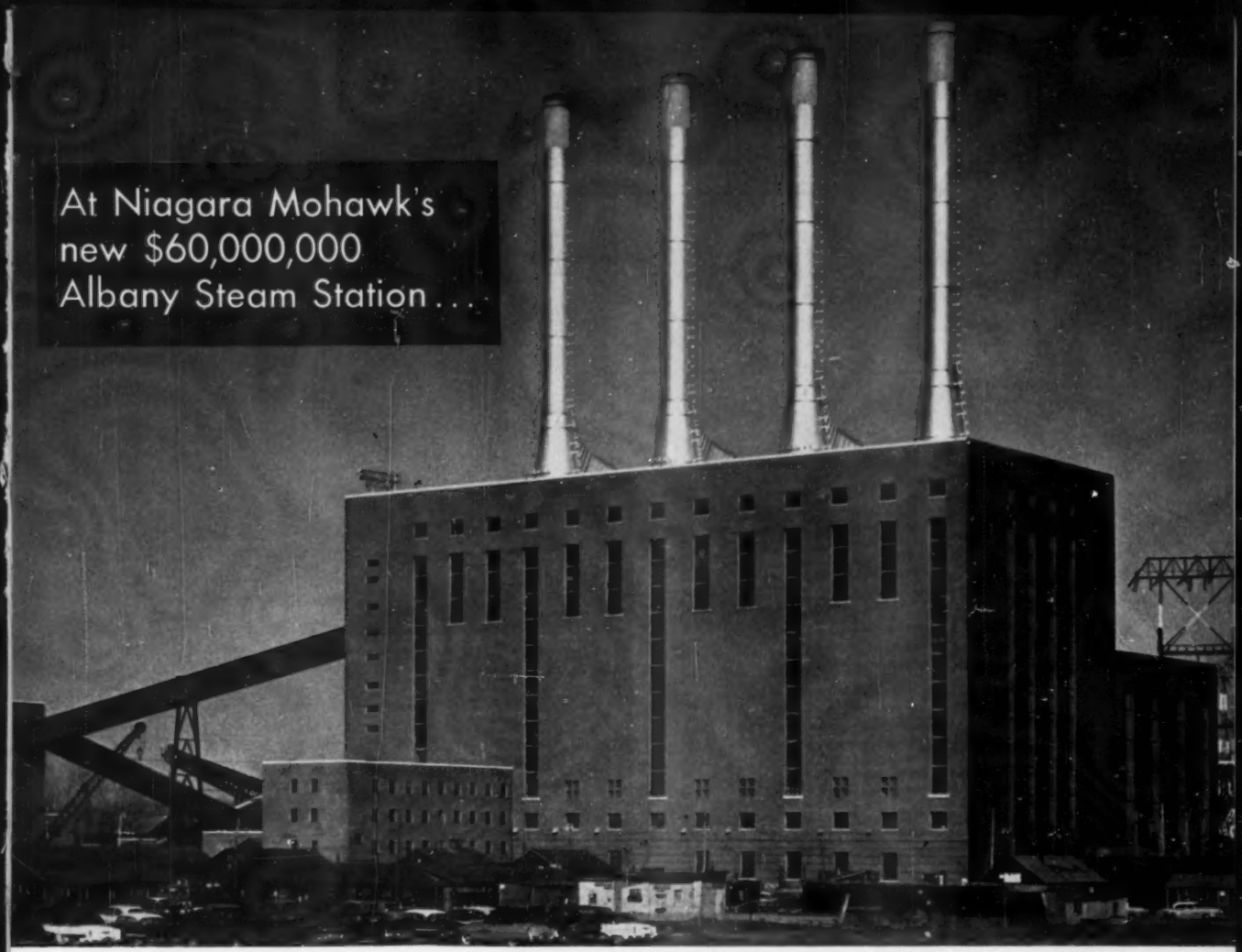
Sidewalk superintendents are getting better breaks all the time, as more construction companies discover it's good public relations to make it easy to watch job progress. But what looks like an all-time high has been reached on a Virginia Electric & Power Co hydro project at Roanoke Rapids.

On a hillside overlooking the project there's a rustic porch for visitors, parking space for about 200 cars. In solid comfort, amateur "supers" can watch work on the 2930-ft dam and 140,000-kw powerhouse.

Atomic-powered carrier of the Forrestal class now gets another look from the Navy after earlier plans went dormant. For this proposed flattop, fifth of the class, Bethlehem Steel Co's Fore River shipyard has been tentatively picked to construct the vessel and put the power plant into it. The reactor would come from Westinghouse; Newport News Shipbuilding & Drydock Co would build shielding.

Use of natural gas in electric power plants has increased more than nine times since 1935. Compare that with growth in total usage of some 400% and you see why the power-plant load is a key factor in this fast-stepping industry.

Lou Lowley



This 400,000 KW station produces 2,600,000 lb./hr. of steam at 1450 psig.

Permutit Demineralizers deliver highest quality make-up . . . and save money, too!

Albany Station's Mixed-Bed Demineralizer was guaranteed to produce make-up of not over 0.5 ppm total solids (about 1 micromho in conductivity), silica of not over 0.1 ppm. It is consistently delivering *better* make-up—0.1 to 0.3 micromhos in conductivity, silica of 0.03 ppm.

Operators are enthusiastic! They like the availability of this Permutit Demineralizer. It is independent of the heat cycle—supplies plenty of make-up for filling a boiler after a shutdown, delivers water at low loads when evaporators would not be available.

Automatic Regeneration saves money! High-capacity Permutit ion exchange resins require fewer regenerations. Motor-driven valves automatically backwash and separate the two resins, individually regenerate and rinse the beds, evenly blend the resins and return the unit to service. Operators have only to keep charges of regenerating chemicals ready.

For performance and cost data on this installation or aid in solving your water problem, write The Permutit Company, Dept. P-12, 330 West 42nd Street, New York 36, N. Y., or Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.

WATER CONDITIONING HEADQUARTERS

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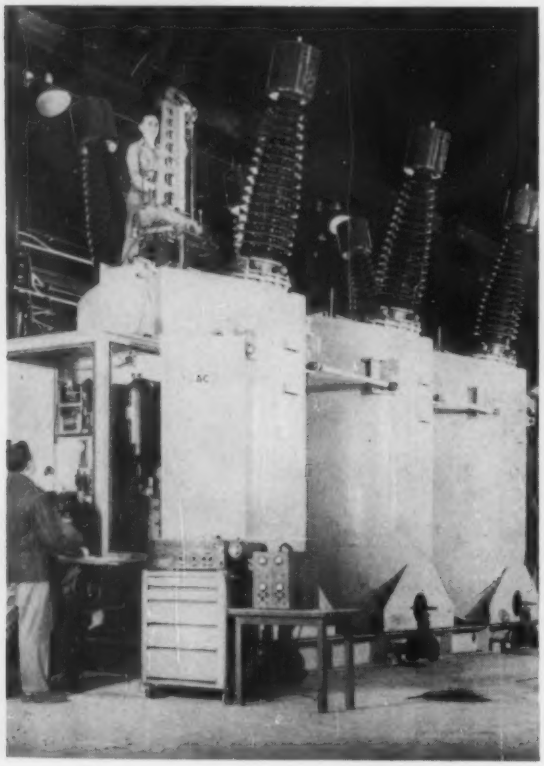
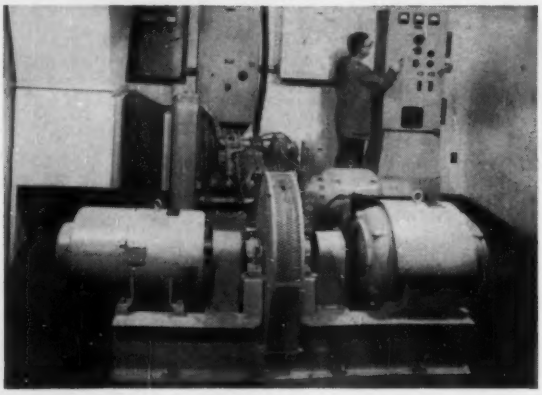




FLYWHEEL motor-generator sets, designed to sustain power for 7 sec after an outage, provide energy sufficient to prevent output from falling below 50 cycles for that time. Automatic transfer control cranks propane-powered standby engine to obtain power before operation is impaired. When line power is restored, load is automatically transferred back to flywheel set. Manufactured by Electric Machinery Mfg Co, unit consists of 20-hp, 1750-rpm induction motor driving 6.25-kva, 120/240-v, 60-cycle synchronous generator through flywheel.

FIRST hydraulically-operated 230-kv breaker is shown on the test floor at Allis-Chalmers Boston works. Rated at 10,000,000-kva, unit is one of four to be installed on a western power system. Each pole utilizes a three-cycle *Turbo-Ruptor* mechanism enclosed in a new tank design requiring a minimum of oil. Height of the breaker is 18-ft and weight is 82,000 lbs.

For coming events see page 246

Boiling-water reactor designed to produce 20,000 kw of heat

► SARGENT & LUNDY, Chicago, has been selected as architect-engineer for design of the Experimental Boiling Water Reactor (EBWR) authorized as part of the Atomic Energy Commission's five-year program for development of competitive electrical power from nuclear fuel. Allis-Chalmers Manufacturing Co will design, develop, construct and install power generation, heat transfer and special equipment for the cycle.

To be built on the Argonne National Laboratory site in DuPage County, Illinois, EBWR will produce 20,000 kw of heat and 5000 kw of electricity. The reactor will use slightly enriched uranium fuel and be moderated and cooled by ordinary water.

Development and construction follows promising investigations conducted by the Argonne research staff during which a small temporary reactor converted water into steam directly without use of an intermediate heat exchanger. These studies, and others, conducted by Argonne are aimed at producing electrical power from nuclear fuel to economically supplement conventional fuel in meeting the nation's demand for energy.

A boiling-water reactor is claimed to have the following advantages over conventional circulating-water reactors: the steam generator normally required for pressurized water reactors is eliminated; pumps can be smaller and less expensive because the only pump requirement in the primary circuit is to return water from the condenser to reactor vessel; reactor will operate at lower pressure and lower maximum temperature than pressurized water reactor systems, thereby simplifying fuel and structural materials problems.

EBWR is to be a small scale pilot plant and electricity produced will not be competitive with power from large central-station plants. Information gained from its construction and operation is expected to contribute significantly toward the ultimate goal of commercial nuclear power.

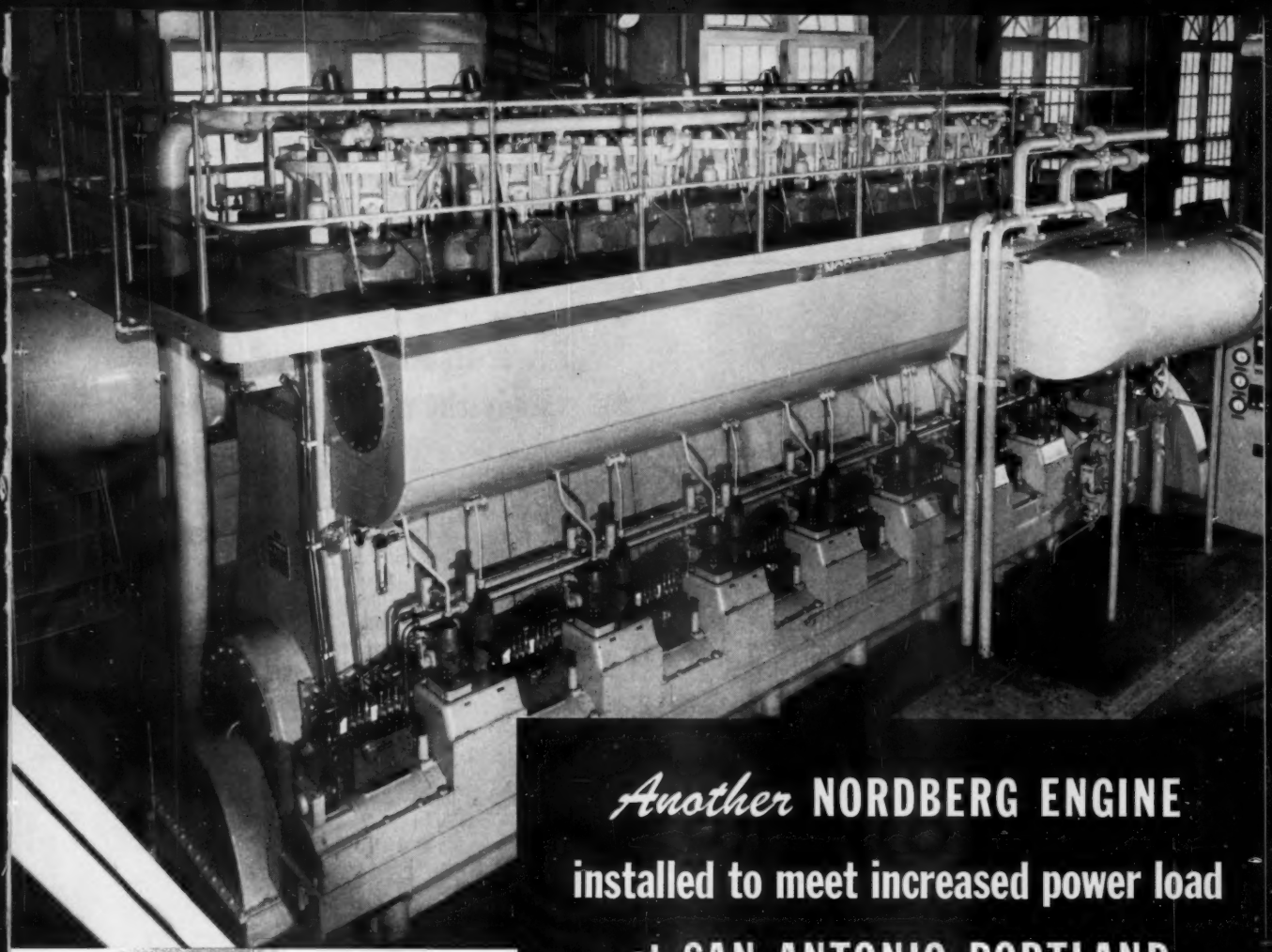
Improved process developed for arc welding mild steel

► HIGHER WELDING SPEEDS, better quality welds and lower operating costs are claimed benefits of a new consumable-electrode, inert-gas arc welding process developed by Westinghouse Electric Corp. The process has been field tested and is now in production. Field tests disclosed a 15 to 20% faster welding speed at 25 to 50% lower cost than other manual and semi-automatic inert-gas methods.

"The consumable electrode welding process is not new," stated W J Delaney Jr, manager of the arc welding department, Buffalo, New York. "It has been used for several years to weld stainless steel and aluminum. Now, however, with this new system, it is economically possible to weld mild steel."

Welds produced by this system can be painted without cleaning as there is virtually no spraying or spatter of elec-

(*Continued on page* 238)



Another NORDBERG ENGINE installed to meet increased power load at SAN ANTONIO PORTLAND CEMENT COMPANY

SAN ANTONIO PORTLAND CEMENT COMPANY, one of the pioneer producers in the cement industry, has an enviable reputation for its efficient operation and quality product. Knowing that low cost power means lower cost cement production, this progressive company has long depended upon Diesel generating units as the main source of processing power for their Cementville, Texas plant.

The first Nordberg engine, a 3600 hp, 2500 kw gas burning unit, was installed in the San Antonio plant in 1948. In 1953, when additional capacity was required, another large Nordberg gas burning engine was installed—a 3010 hp, 2100 kw unit.

It is interesting to note that while this plant has a total of eight Diesel generating units, the two Nordberg engines represent over half of the total installed horsepower and carry 75% of the total load.

This is one more example of the way Nordberg Engines are being used to provide dependable, low cost industrial power. Next time you have a power problem think of Nordberg . . . builders of America's largest line of heavy duty engines, from 10 to over 10,000 horsepower.

NORDBERG MFG. CO., Milwaukee, Wisconsin

NORDBERG

DIESEL • DUAFUEL® AND SPARK-FIRED GAS ENGINES

P454

TECHNICAL BRIEFS

Latest engineering developments for busy power men

13 Digests for you on:
ELECTRICITY
NUCLEAR ENERGY
LUBRICATION
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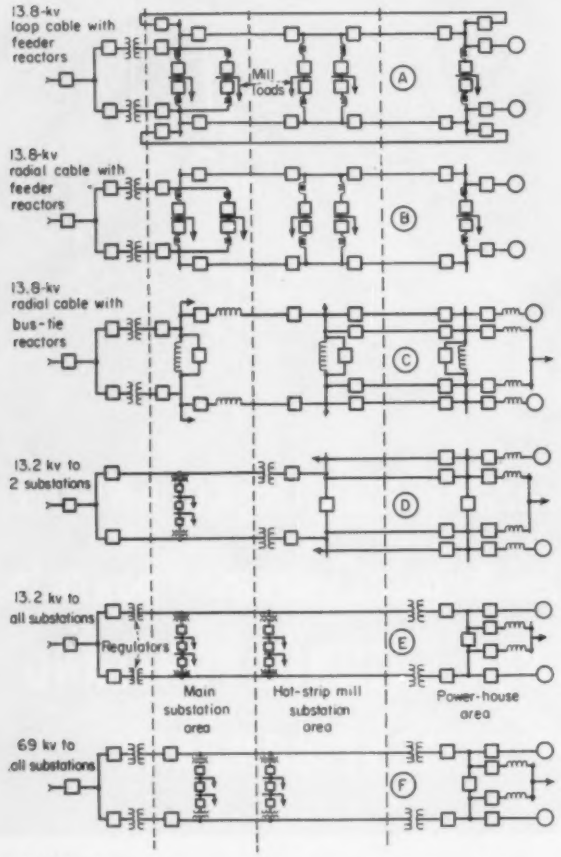
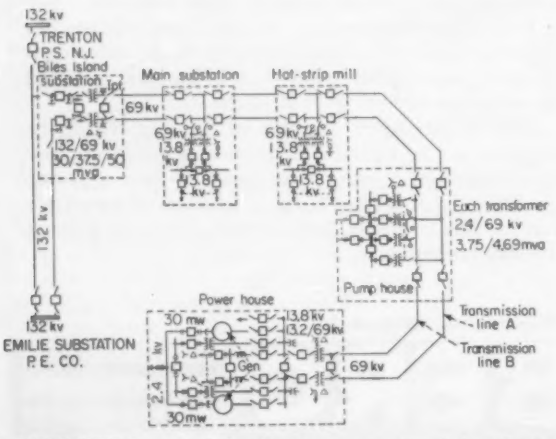


1 **LAYOUTS** of six schemes studied during design of the electrical distribution system for the Fairless Works of U.S. Steel



2 **SCHEMATIC** layout of distribution system installed at Fairless Works. Construction and installation was extremely rapid

Power-transmission system study shows best layout

A-c power system at the Fairless Works. *By S S Watkins, Gibbs & Hill, Inc, W A Derr, L L Fountain and R B Squires, Westinghouse Electric Corp.*

Fairless Works of U.S. Steel, located on a bend in the Delaware River near Morrisville, Pa., was designed as a completely integrated plant, capable of processing raw materials into finished steel products, ready for industrial use. Seldom in the history of steel mills have engineers had the opportunity to design so complete an undertaking in its entirety, thereby taking advantage of past experience from both technical and economic standpoints.

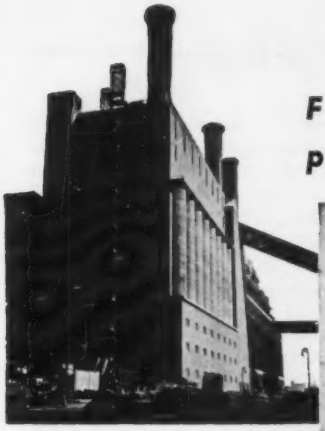
Since this is a completely new works, it was possible to design the system for minimum costs and maximum flexibility. Six different types of power transmission systems were studied, Fig. 1. These differed in voltage level, and consisted of either radial or loop feeds with reactor components to reduce fault currents where needed. The a-c network calculator was used in these studies, making it possible to check fault currents, voltage regulation, and other pertinent characteristics in the operation of a system.

System chosen, Fig. 2, is similar to Fig. 1F. To increase flexibility, 69-kv breakers were used at all substations. At the same time, considerable economic advantage over any of the other schemes was maintained.

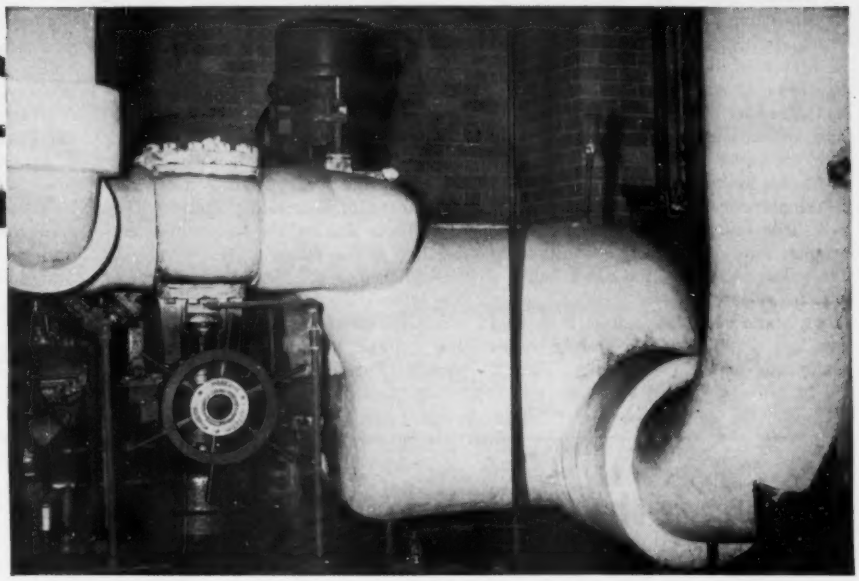
One of the largest installations of its kind ever designed, manufactured and installed in so short a time, results are most satisfactory. Within about two years after the first calculator study of proposed designs, all electric power equipment was installed and ready for use. This included five large outdoor substations, the 69-kv high-tension line and power house, in addition to substations in every mill area. *AIEE paper No. 54-348.*

Synchronous condensers for steel mill service. *By E I Pollard, Elliott Co.*

The synchronous condenser has been practically superseded by the static capacitor as a means of power factor



For this addition to their New York City power plant at East River and 14th Street . . .



(Above) View of recently completed annex to Consolidated Edison's power plant . . . another link in their gigantic expansion program. **(Right)** Close-up of J-M 85% Magnesia Insulation on boiler feed lines. It was expertly installed by the Asbestos Construction Company, Inc., an outstanding J-M Insulation Contractor.

CON EDISON SPECIFIES J-M 85% MAGNESIA PIPE INSULATION FOR MAXIMUM FUEL SAVINGS

Like all materials that went into the new power plant addition of New York's leading gas and electric supplier . . . the pipe insulation had to be the *best*. That's why Consolidated Edison Co. specified J-M 85% Magnesia . . . industry's No. 1 insulation for many decades and *still* the leader in its class.

J-M 85% Magnesia is the leading insulation on the market for temperatures up to 600F. It is bonded with asbestos fibers. This rugged insulation will not distort regardless of the length of time it stays in service. J-M 85% Magnesia fits snug and stays put. Heat savings, therefore, remain constant for the life of the equipment on which this insulation is applied.

For temperatures over 600F, J-M 85% Magnesia is used in combination with Superex*, a J-M insulation for service to 1900F. This double-layer construction, known as Superex Combination, eliminates through joints and protects the jacket against scorching. It also utilizes the higher heat resistance of Superex next to the hot surface, and the greater insulating value of J-M 85% Magnesia for the outer layer.

Reg. U.S. Pat. Off.

Experience has proved that all insulations must be properly installed to pay maximum dividends. That's why Johns-Manville offers industry the services of experienced insulation engineers and installation contractors who have made a career of solving complex insulation problems. From coast to coast, these engineers and the contractor's highly skilled mechanics stand ready to combine their talents and give you an insulation job that will more than pay off your initial investment with maximum fuel savings through the years.

When you face your next insulating problem . . . remember that Johns-Manville is "Insulation Headquarters." Consult your near-by J-M Insulation Contractor . . . or write direct to Johns-Manville, Box 60, New York 16, New York. In Canada, write 199 Bay Street, Toronto 1, Ontario.

Skilled Applicators on the team of a J-M Insulation Contractor applying J-M 85% Magnesia to pipelines. Located throughout the nation, these contractors have had years of experience handling all types of installations. They know J-M 85% Magnesia and other J-M insulations as *quality* products, and take pride in applying them properly. Result: an insulation job that pays dividends through the years in maximum fuel savings.

Johns-Manville *FIRST IN* INSULATION

MATERIALS ENGINEERING • APPLICATION

More TECHNICAL BRIEFS

Begins on page 168

Electricity

Continued from page 168

correction, where only steady-state condenser capacity is of primary importance, for reasons of both initial cost and cost of operation. However, the synchronous condenser has marked advantages over the capacitor for transient and subtransient operation during rapid load changes.

A dip in voltage at the condenser terminals due to load increase causes it to feed more capacitive kva into the system, thus diminishing magnitude of the voltage dip. On the other hand, a dip in voltage at the terminals of a shunt static capacitor causes it to feed less kva into the system and increases magnitude of the voltage dip. Thus a synchronous condenser assists in smoothing out system voltage fluctuations while a capacitor magnifies fluctations.

The arc furnace is subject to frequent and severe short circuits during the melting-down period. It is therefore a particularly difficult load to handle from the standpoint of maintaining reasonably steady voltage in the steel mill and nearby portions of the power system. A synchronous condenser connected to the furnace bus is a convenient means of controlling these voltage fluctations and at the same time correcting power factor.

Addition of a buffer reactor between the furnace bus and the system increases effectiveness of the condenser in reducing voltage fluctations on the power system. Further addition of a capacitor in series with the condenser, between the condenser and the furnace bus, enhances still further the effectiveness of the condenser in minimizing voltage fluctations on the system. Curves are presented indicating improvement in voltage fluctations as a function of condenser size with and without a buffer reactor and series capacitor, for a typical installation.

A condenser of special design with lower than standard subtransient and transient reactances should be considered for this service. This and other desirable electrical characteristics and design features of condensers for arc-furnace application are discussed. Advantages and disadvantages of hydrogen-cooled condensers are considered. *AISE paper; no number.*

Directions for ordering papers are given on page 236

Six aspects of nuclear-energy utilization reveal the many complex problems now facing the industry

Patent provisions of the atomic energy act of 1954. *By Bennett Boskey.*

Patent provisions are concentrated in Sections 151 through 160 of the new act. In addition, a number of provisions scattered elsewhere throughout the act have a significant bearing on patents and inventions.

Under the new act the field of production of fissionable material, or of special nuclear material, has been restored to the patent system. This goes side by side with other provisions making it possible for private enterprise, pursuant to a licensing system administered by the commission, to invest in and to own and operate facilities in the field of production of special nuclear material and of power.

There has been an enlargement of areas where reporting of inventions is required. These areas include not only utilization of special nuclear material or of atomic energy in atomic weapons, but also "the production or utilization of special nuclear material or atomic energy." The paper details three types of proceedings coming before the Patent Compensation Board. Compulsory licensing provisions of the new act are discussed. *AIF paper; no number.*

Insurance problems of the atomic industry. *By Stuart MacMackin, Atomic Products Div, General Electric Co.*

Three reasons for good insurance protection in the atomic industry are (1) magnitude of possible atomic catastrophe is such that liabilities could easily exceed the assets of any corporation found to be the legal cause of the mishap (2) insurance is an efficient and desirable method of spreading the risk (3) the industry needs policing and safety advice that it has come to expect from the insurance industry.

Because the problem is so large and the sums involved so great, a complete reorientation of thinking is required, not to mention the need to develop new methods of organizing reserves to meet forseeable losses.

The paper also discusses legal background on third-party liability, possible fact situations, present limits of available insurance, and a proposal for further discussion and thought. *AIF paper; no number.*

Investment problems and opportunities in atomic energy. *By Carl M Loeb, Rhoades & Co.*

This paper covers many phases of the business side of atomic energy, including uranium mining, "ium" stocks, concentrating and refining, massive companies, instrument and engineering companies, machinery companies, by-products, and utilities.

Except in a few outlying areas of the U.S., atomic fuel is not likely to importantly stimulate utility industry growth immediately. Provisional projects assume that atomic energy will be used in about 10% of the new plants built after 1960, 20% by 1985, and about 50% by the year 2000.

Outside the U.S., in areas where coal, water, oil or natural gas are lacking, there may be reason to develop atomic power more rapidly, provided there is money to build the plants. We can visualize atomic power opening the great Northwest Territory of Canada, which is hungry for power plants for development of its great mineral resources. *AIF paper; no number.*

The new atomic energy law—what it means to industry. *By John W Landis, The Babcock & Wilcox Co.*

B&W anticipates making complete nuclear steam generators — beginning with fuel elements and on through to turbine throttle. Transition to nuclear power will not be sharp. Over-all demand for power is increasing so fast that coal and fluid hydrocarbons will probably be consumed in greater and greater quantities for the remainder of this century.

Some uses B&W envisages for nuclear-power equipment include central-station power plants, ship propulsion, industrial heat and process, conversion of sea water to fresh water, aircraft propulsion, large central heating plants, production of fissionable and fusionable materials, package power plants for remote or unusual locations, large scale catalysis of chemical reactions and production of radioisotopes.

A "share-the-expense" proposal for a 200,000-kw unit sees construction cost of a new plant of conventional design

(*Continued on page* 224)

Whatever your fuel needs, we have a coal that is

Just the Ticket!

● In fact, you can write *your own* ticket—for the vast Bituminous fields served by the Baltimore & Ohio contain excellent coals *in wide variety*. For centuries to come, these coals will be available—a dependable source of low-cost heat and energy.

Modern mechanization at the mines assures low costs as well as uniform size and quality. The location of the fields—close to industry's front door—contributes to low transportation expense. Storage is economical because costly facilities are not required. And with the help of new combustion methods and equipment, Bituminous offers its users an increased burning potential.

ASK OUR MAN! He can give you worthwhile advice as to supply sources and burning methods for the particular coal you need. The efficiency, economy, and cleanliness of B&O Bituminous today will be a revelation!

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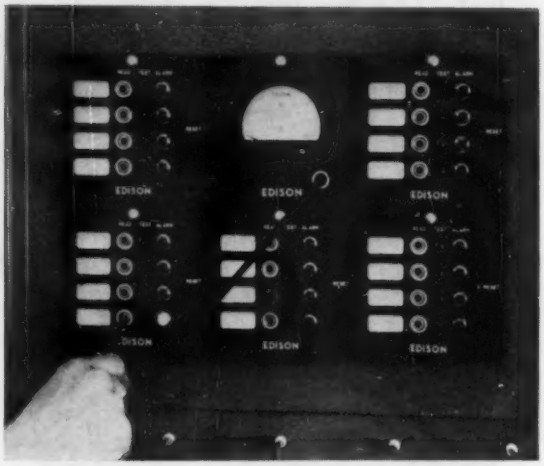
Published monthly as a service to readers

V W ROSE and H R Karp, Thomas A Edison, Inc, Instrument Division, demonstrate *Omniguard* system to Kenneth A Roe (center) executive vice-president of Burns and Roe, Incorporated



ONE indicator unit serves as many monitor units as required. Jack cord can be plugged into any point for a temperature reading. Lamp signals approach of trouble at any one point

Multiple-point temperature monitoring available without scanning

1200 • Temperature monitoring system *Omniguard* is designed to protect a few or several hundred remotely scattered points from temperature excesses. Low cost, minimum maintenance and extreme flexibility are claimed features of the unit. Unique design advantage is that monitor units and indicator can be mounted close to the equipment to be protected and at the same time a master alarm signal can be carried through a single pair of copper wires to a central control room at a great distance away. This reduces installation cost due to minimum wire routing.

Omniguard is a complete system whether 4 points are installed or 400 points. An original installation can be increased to any multiple of 4 points up to several hundred. Additional units can be added without disturbing or affecting existing units or wiring.

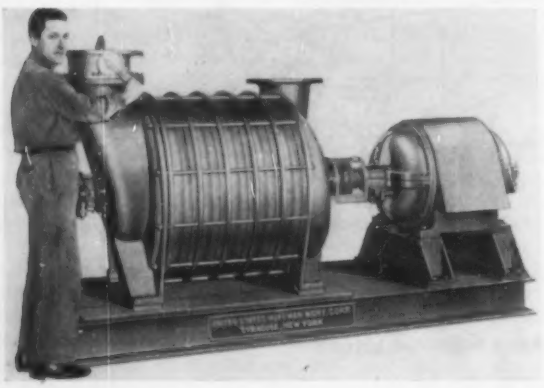
Exclusive feature of the system, according to manufacturer, is that it monitors each and every point simultaneously—without scanning. This means that no point is ever left unguarded even when several hundred points are under surveillance. When a given point reaches a "critical" temperature, the alarm sounds instantly.

Omniguard operates without moving parts. It has no electronic components, requires no constant adjustment and literally will need no maintenance other than routine checking, the manufacturer states. Temperature setting of each point is accomplished on the panel without special tools. Each monitor unit is completely self-contained and can be removed from the panel without disconnecting a single wire.

The system is in mass production on an assembly line basis. Monitor and indicator units can be stocked and delivered off-the-shelf since temperature settings for each point can be made before or after delivery. For complete information request publication 3036 from manufacturer.

Thomas A Edison, Inc, Instrument Division, West Orange, New Jersey

For more data on these items, use post cards p 181. Identify your request with item number



Multi-stage centrifugal blower

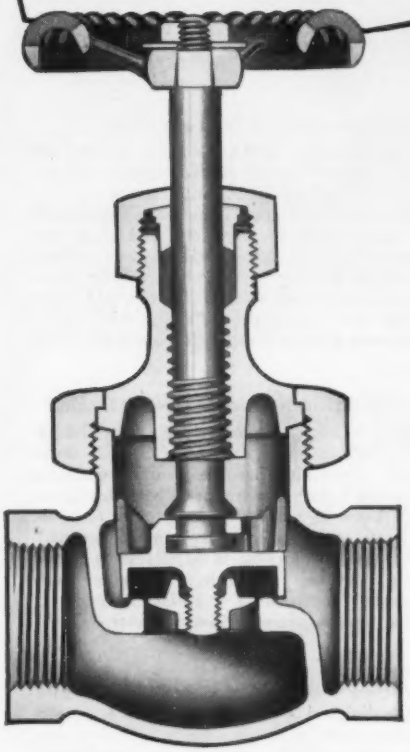
1201 • Multi-stage standard production centrifugal blower is capable of delivering air volumes between 1500 and 5000 cfm, with pressures ranging from 1 to 9 lbs gage, or vacuum from 2 to 12 in. Hg.

Units use two interchangeable impellers and are self-adapting to any variation in air volume requirements from minimum to maximum capacity. Designated *Series 385* the blower can be factory assembled to meet individual needs of customers.

Units can be equipped with impellers that impart a non-overloading characteristic. Manufacturer states that there are no internal wearing parts. Rotor and housing are designed to permit free air flow, and each impeller is statically balanced. Rotating element is dynamically balanced to prevent vibration, resulting in a continuous 24-hour-a-day operation without adjustment.

Air Appliance Div, U.S. Hoffman Machinery Corp, 105 Fourth Avenue, New York, New York

A New Disc . . .
A "New" Valve



Crane No. 7 Brass Valves with quick-change composition disc

Save time, trouble, and money by standardizing on these Crane quality 150-Pound Valves. No big inventory of replacement parts. Just a few extra disc holders . . . a supply of composition discs. That's all you need for a wide variety of fluids . . . and an economical maintenance program.

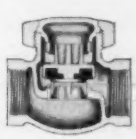
The composition disc takes most of the normal wear—stands up well under ordinary usage—seats easily even on air and gas—absorbs foreign particles that might cause leakage in metal disc valves. When a leak shows up, make a "new" valve—with a new disc. Simply dismantle the union ring, lift out the trimmings, replace the disc holder assembly. Takes only a few minutes. Save the disc holder you removed—use it with the next replacement disc.

Rugged construction throughout. Sturdy bonnet joint, well reinforced by heavy union ring—can be repeatedly dismantled and reassembled. Get better acquainted with the Crane No. 7 line . . . for steam, hot and cold water, air, oil, gas, gasoline, and many other fluids.

No. 7 Globe
Sizes ⅛ to 3-inch

No. 7 Angle
Sizes ⅛ to 3-inch

Specify No. 9 for Flanged Ends



No. 27 Check
Sizes ¼ to 3-inch

GLOBES, ANGLES, AND CHECKS

Ask for folder AD-1682R—contains full facts on the No. 7 brass valve line and the companion No. 27 check. Your Crane Representative has a copy for you—or write direct to address below.

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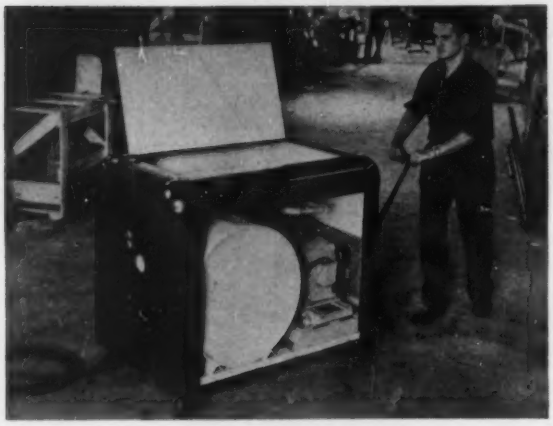
More EQUIPMENT NEWS

Begins on page 172

Check these latest pump designs

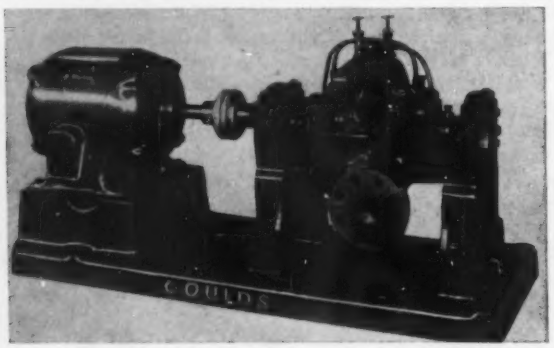


Movable vacuum pump unit has 50-gal surge tank

1207 • Termed by the manufacturer as the first movable vacuum pump, unit can be moved to point of installation and connected by hose to equipment used in numerous vacuum applications. Push-button operation begins as soon as pump is plugged into an ordinary electrical outlet. Unit includes an air-cooled rotary pump with adjustable vacuum shut-off switch, 50-gallon welded surge tank, thermal overload protection, and exhaust filter.

Amount of vacuum can be easily controlled with potential to 29½ in. at sea level. Features include top-door opening, rubber-tired ball-bearing wheels, and varying electrical requirements.

Vacuum Forming Corporation,
76 S Bayles Ave, Port Washington, New York



Two-stage pumps provide capacities to 1000 gpm

1208 • Two-stage pumps for handling clear liquids are available in 5 sizes, providing heads to 1000 ft and capacities to 1000 gpm. Pump casing is horizontally split—interior can be inspected and rotating parts removed and replaced without disturbing piping connections. Standard features include sealed bearing housings, cowl-type glands, stainless steel impeller keys, *Teflon* water-seal rings, corrosion-resistant gland bolts, renewable stuffing box bushings and die-formed packing. Pump can be supplied with either conventional stuffing boxes or with mechanical seals.

Goulds Pumps, Inc, Dept PR, Seneca Falls, New York

Submersible pump for wells to 280 ft deep

1209 • Submersible pump is designed for deep wells to 280 ft and for providing capacities to 940 gph from shallower settings. Available in ½, ¾ and 1 hp models. Features include encased electric cable, 3-point bearing construction and non-reversing protection. Complete information available in bulletin B-2455.

Peerless Pump Division, Food Machinery & Chemical Corp,
301 West Avenue 26, Los Angeles 31, California

Vacuum pump exhaust separator cuts noise

1210 • Device is claimed to effectively extract 100% of water from water-sealed vacuum pump exhausts and simultaneously reduce noise of gas discharge to ear-comfort level. Both water and air enter side of the device and are separated centrifugally. Water-free air is discharged at top, water at bottom, of unit. Although water separation is prime purpose of the device, it also reduces discharge noise from vacuum pump sufficiently for most commercial installations. Units are available to handle 60 to 4700 cfm.

Burgess-Manning Co, Libertyville, Illinois

Gage measures inside tube diameters

1211 • Tube gage measures inside diameters of small tubes and sheet openings in condensers and heat exchangers to .001 in. Measuring is done by three hardened steel balls that protrude from a hollow steel barrel—giving three-point contact for accurate tube measuring. Inside diameter is read directly from dial. Bulletin Y-39 available.

Elliott Co, Lagonda Div, Springfield, Ohio

Ac welders rated to 500 amperes

1212 • Industrial welders, NEMA rated 300, 400 and 500 ampere models, feature stepless current control, silicone insulation, aluminum coil windings, large current scale.

Wide current ranges enable units to be used on practically all industrial applications ranging from light-duty, low current, to heavy-duty, high current welding jobs. Manufacturer recommends unit for heavy section welding where high current is desirable and when arc blow would otherwise cut welding speed and quality. Bulletin ADC 719.

Air Reduction Sales Co, 60 E 42nd St, New York, N.Y.

Compact indicating temperature controller

1213 • Remote indicating temperature controller is claimed accurate within one percent of full scale under most conditions. Controller has temperature operating range of 100 to 700 F with uniform sensitivity throughout the range. Unit has a 15 amp power relay, with room for an additional warm-up relay, in separate wiring compartment inside the case. Differential is adjustable to permit reducing equipment cycling rate when wider control bandwidth is acceptable. May be flush or surface mounted.

Fenwal Inc, Ashland, Massachusetts

Safety panel protects unattended engines

1214 • Panel is designed to protect unattended or remote-controlled engines, such as on oil rigs, irrigation pumps, air compressors, sump pumps, generators, etc, from burned bearings, frozen pistons or other failures. Designed for engines with battery ignition, panel consists of an oil pressure gage and water temperature gage in combination with engine shut-off switch, ammeter, stop switch and re-set. Should oil pressure of engine drop or temperature rise to a dangerous level, panel automatically shuts engine off.

Stewart-Warner Corp, Diversey Pkwy, Chicago, Ill.

Direct burial cable combats corrosion

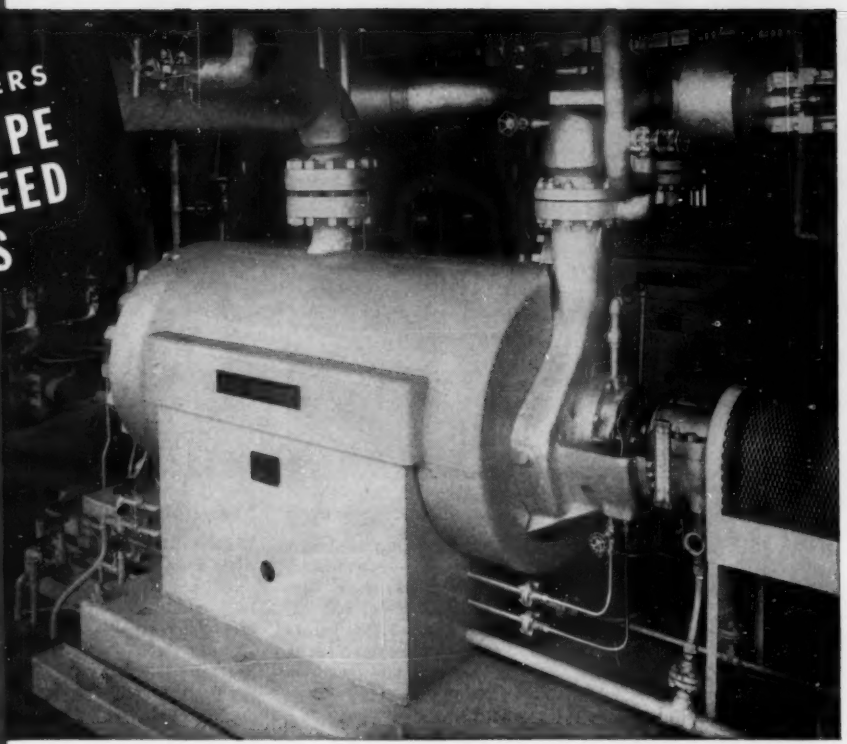
1215 • Direct burial cable *Type CP* is claimed to effectively combat corrosion in refineries and around tank forms, throughout pipeline systems, in booster stations, and around power plants and substations. *Type CP* cable is all-plastic with a polyethylene insulation and red PVC jacket. Available in sizes 8 through 4/0, single conductor, 600 volts.

Anaconda Wire & Cable Co, New York 4, N. Y.

To obtain additional information on these items, use the post cards on page 181. Identify your request with the item number.

ALLIS-CHALMERS

BARREL-TYPE BOILER FEED PUMPS



Preferred by
LOUISIANA POWER & LIGHT COMPANY
because

PERFORMANCE IS PROVED *in service*

PERFORMANCE RECORDS in power plants all over the country show *low maintenance, high efficiency*... that's one reason Allis-Chalmers boiler feed pumps were chosen for the Nine Mile Point Station of Louisiana Power & Light Company.

PROVED DESIGN FEATURES
Behind the A-C boiler feed pump stand many proved design features. For example: First stage has twin, single suction impellers to give low NPSH requirements for highest efficiency under fluctuating loads. Impellers mounted back to back balance axial forces without the need for a balancing drum. Expansion joint and seals are brought to the outside of the pump . . . they may be inspected often and worked on easily, if required.

COMPLETE UNIT FROM THE SOURCE
Allis-Chalmers can supply the complete pumping unit — pump, motor and control — all of coordinated design and manufacture. You get one responsibility — one guarantee of satisfaction.

Get complete information on Allis-Chalmers barrel-type boiler feed pumps. Call your Allis-Chalmers District Office or write Allis-Chalmers, Milwaukee 1, Wis., and ask for Bulletin 08B7899.

A-4328

ALLIS-CHALMERS A-C

More EQUIPMENT NEWS

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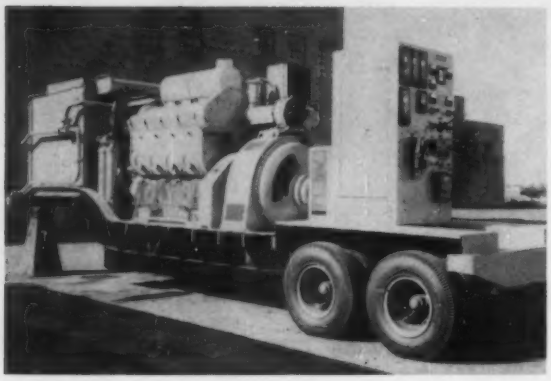


Mobile electric generating units are diesel-powered

1205 • Electric power generating plants in two forms—mobile and portable—are designed to meet fringe area, low-load-factor situations. Mobile units for highway transport (above) have capacity ratings of 350 or 500 kw. Railroad units are of 500, 750 and 1000 kw capacity. The units may be coupled together to obtain, for example, a hundred thousand kw or whatever capacity is necessary to put an average American city back into operation after a disaster of war or nature. (*Ed Note: Need for such units were discussed in the February, 1951 issue of* POWER, *page 82.*)

Portable plants, mounted on skids and capable of being put on railroad cars or truck trailers for transport, are designed for more permanent installations. They are of 350, 500, 750 and 1000-kw capacity.

All units are powered by the *GM 567C* diesel engine in 6 to 16 cylinder sizes. Generators used have been designed to withstand a 25% overload and to operate at 4160 or 2400 v, ac. Complete details available on request to the manufacturer.

Electro-Motive Div, General Motors, La Grange, Ill.

Fan-cooled wound-rotor motors are totally enclosed

1206 • Rib-type enclosed, fan-cooled wound-rotor motors are made with slip rings, brushing rigging, rotor and stator inside a single frame enclosure. The UL approved units are available at 1800 rpm and slower speeds, in frames 284 to 505, in standard enclosed or explosion-proof construction.

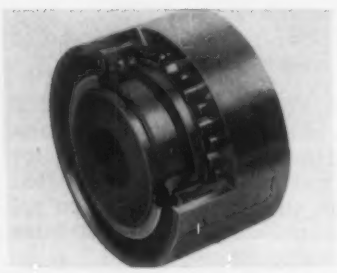
Motor frame has an extended front end to include slip rings, brushes and brush rigging. Removal of two large pipe plugs from upper quadrants of frame on the slip-ring end provides large openings for maintenance work and adjustments. Slip-ring leads enter a separate cast-iron conduit box and the lead opening in the frame is sealed.

The wound-rotor unit is applicable to low starting current, high starting torque, smooth acceleration, jogging or variable speed applications. Totally-enclosed it may be used in moist, dirty, corrosive or hazardous atmospheres.

Construction features are described in leaflet 51R8195, available on request to the manufacturer.

Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

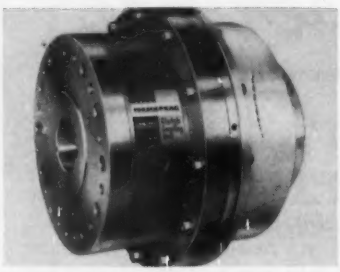
Three coupling units to aid solution of mechanical drive problems



Cam clutches for indexing

1202 • Self-contained cam clutches *Series HT* include a single row ball bearing that helps maintain concentricity of inner and outer races. They are designated for use on stepped shafts in machinery drives. Units feature constant pitch spacing, alternate cam and roller construction. Adaptable to general duty over-running and backstop operations including dual drives, feed rolls and two-speed applications.

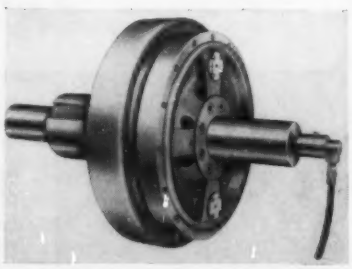
Morse Chain Co, 7601 Central Ave, Detroit 10, Michigan



Clutch coupling units

1203 • Full complement unit is designed for applications where over-running features are required in conjunction with a flexible coupling. Two types of construction within the same space limitations are available. One is to be used for low speed over-running applications; the other where practically continuous high-speed over-running conditions are encountered. Descriptive bulletin on request to manufacturer.

Formsprag Co, 23601 Hoover Rd, Van Dyke, Michigan



Quick-action air clutches

1204 • Unit responds instantly to a touch of throttle, manufacturer claims, because minimum of air is used in operation. This sensitivity provides finger-tip control and an ability to "inch" clutch or throw it into full engagement, as required. Disengagement is achieved by use of release valves built into the clutch itself. Available in single and double plate models from 8.5 to 806 hp per 100 rpm at 80 psi.

Dodge Manufacturing Corporation, Mishawaka, Indiana

For more data on these items, use post cards p 181. Identify your request with item number

MEMO

Powell has a complete line of steel valves for power plants!

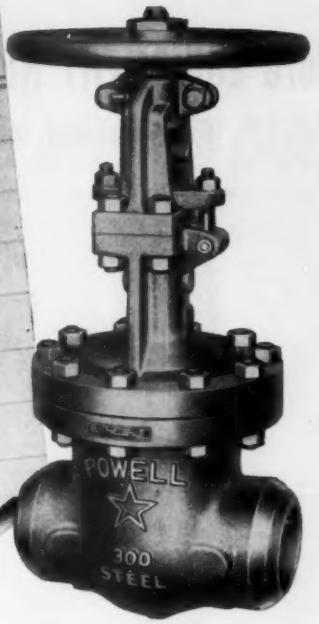


Fig. 3003-WE — CAST STEEL GATE VALVE for 300 pounds W.S.P. Bolted flanged bonnet with outside screw, rising stem and yoke. Sizes 1″ to 24″, inclusive.

Shown here are just a few Powell Steel Valves for power plants. Whichever type you choose, you can be certain of *dependable* flow control.

Investigate the complete Powell line—valves that have a proven record of long life and dependable service.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our complete line, and help solve any flow control problem you may have. Write The William Powell Company, Cincinnati 22, Ohio.

Fig. 1314-A—CAST STEEL INTEGRAL BONNET "Y" valve for 1500 pounds W.S.P. Also available for 2500 pounds. One-piece construction eliminates body-bonnet joint and possibility of leakage. Sizes ½″ to 2″, inclusive, with socket weld ends.

Fig. 11365—CAST STEEL PRESSURE SEAL HORIZONTAL LIFT CHECK VALVE for 1500 pounds W.S.P. Piston guided disc. Also available for 600, 900 and 2500 pounds.

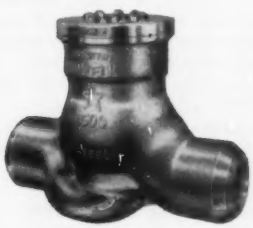


Fig. 11303—CAST STEEL PRESSURE SEAL O.S.&Y. GATE VALVE for 1500 pounds W.S.P. Body-bonnet joint stays tight—internal pressure MAKES rather than breaks the seal. Valves of this design are also available for 600, 900 and 2500 pounds.

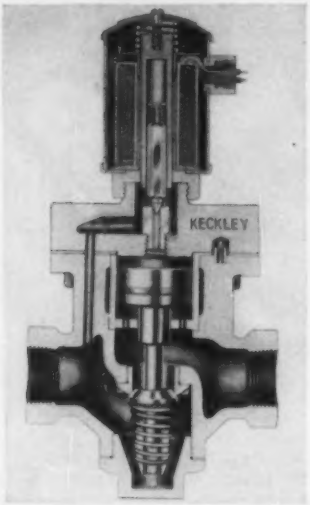
CONTROLS FOR THE LIFE LINES OF INDUSTRY

Powell Valves *108th year*

More EQUIPMENT NEWS

Begins on page 172

Five recent valve developments



Pilot-operated solenoid valves for steam pressures to 250 psi

1216 • Pilot-operated solenoid valves *Type EA* are designed for steam service at pressures to 250 psi, or air, water, oil and gas service to 600 psi. Valve bodies are bronze or semi-steel; pilot valve, main valve and seat are stainless steel. *Teflon* seat rings for both pilot and main valve seat can be used for positive shut-off on air, gas and water service. Solenoid coils are glass insulated moisture-proof type suitable for high temperature and pressure service.

In operation, main valve opens when solenoid pilot valve opens, admitting pressure to top of main valve piston. When pilot valve closes, pressure above piston lessens, allowing main valve to close.

Units available in ½ through 6 in. sizes. Complete information obtainable on request to the manufacturer.

O C Keckley Co, 400 W Madison St, Chicago 6, Illinois

Solenoid-operated 2-way valve

1217 • Stainless steel 2-way valves are designed to control gases and liquids, generally corrosive to bronze, steel or iron, at pressures to 250 psi. They are normally closed (close when de-energized, open when energized) units. Floating-core solenoids provide freedom from core chatter. Can operate at frequency of 400 times per min.

Automatic Switch Company, 391 Lakeside Ave, Orange, N.J.

Pilot-operated valves

1218 • Pilot-operated solenoid valves are available in 30 models for connections from ¼ to 1½-in. Exclusive feature, according to manufacturer, is use of same coil assembly on all numbers for simplification of service and replacement problems. Designed for use with freon 12 and 22, water, air, gas, brine, ammonia, oil, etc.

Jackes-Evans Manufacturing Co, 4427-A Geraldine Ave, St Louis, Mo.

Combination safety valves

1219 • Combination safety valve protects against over-pressure and fuel fed fires in gas installations. Unit is designed for installation immediately ahead of gas meters to eliminate danger of ruptured gas meters, fires, explosions and damage resulting from excessive gas pressures. Unit can be mounted in any position, in any section of piping arrangement between gas meter and pressure reducing valve. Request details.

Valco Inc, 1410 West Ave, Cincinnati 15, Ohio

Four-way selector valve

1220 • Two-position, 4-way selector valve for use in low pressure air or hydraulic systems is claimed to be exceptionally leak-proof at working pressures to 100 psi. Very low handle torque is maintained; handle stops assure positive alignment of ports. Overall dimensions are 3¾-in. wide, 2⅝-in. high. Weight is 6 oz. Complete disassembly may be made without disconnecting system lines. Full details on request.

Sprague Engineering Corporation, Gardena, California

Lubricated take-up bearings

1238 • Welded structural steel bearings *Style P* (horizontal) and *Style T* (wall mounting) are self-aligning and can be loaded in tension or compression. Permanently lubricated, units are equipped with standard 200 series ball bearings with wide inner-ring and deep ball race groove. Bearing is locked to shaft by engaging collar with eccentric and tightening set screw. Shaft rotation increases locking action.

T B Wood's Sons Company, Chambersburg, Pennsylvania

Flow regulators

1237 • Valve automatically controls flow of water at pressures of 15 to 125 psi. Adaptable to most water flow applications, they do not become easily clogged as orifice is completely self-cleaning, according to manufacturer. Constructed of brass, it is available in ½ and ¾-in. pipe sizes for capacities from 2 to 8 gallons per min. Request bulletin GE-854 for details.

Bell & Gossett Company, Morton Grove, Illinois

High-output space heaters

1223 • *Models HB160* and *HB210* have outputs of 160,000 and 210,000 Btu per hr, respectively. Units are shipped with filter located at bottom of furnace for bottom cold air return, with further provision for returning air at either right or left side of the furnace. For space heating an accessory bonnet is supplied, consisting of a rectangular plenum with die-formed louvres on each of its four sides.

Tubular designed heat exchanger is constructed of heavy gauge steel. Combustion chamber is made of pre-formed refractory material. Full details on request.

Delta Heating Corporation, Trenton 8, New Jersey

Insulation tape

1250 • *Den-ite tape* insulates cold lines in air conditioning systems, plumbing and wherever condensation is a problem. No. 8525 cork insulation tape also provides a sound deadening barrier, can be used as a gasketing material. Self adhesive.

Dennis Chemical Co, 2701 Papin St, St Louis 3, Missouri

For more data on these items, use post cards p 181. Identify your request with item number.

CHECK THESE TOO . . .

Zeolite water softeners . . . . . p 186
Air compressors . . . . . p 188
Electric steam generators . . . . . p 190
Lightweight safety suits . . . . . p 192
Feedwater control systems . . . . . p 192
Industrial power unit . . . . . p 194
Automatic speed control . . . . . p 196
Hazardous location starters . . . . . p 198
Voltmeter-ammeter recorder . . . . p 202
5000-volt power cable . . . . . p 204

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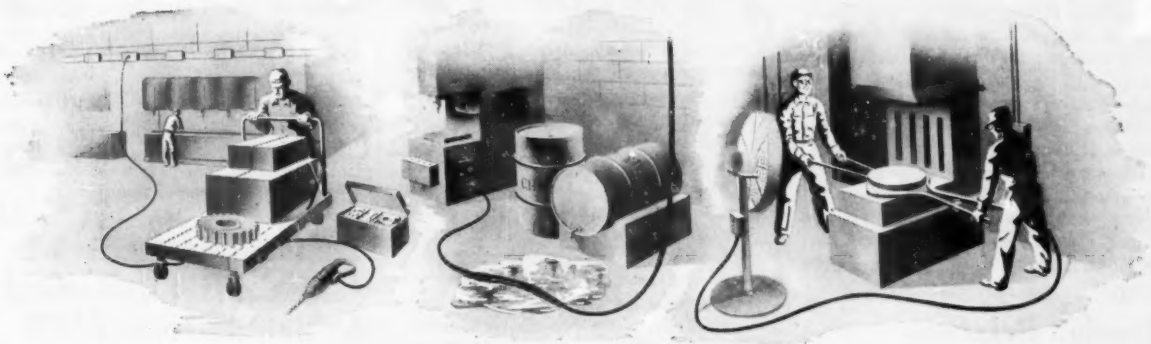
heavy duty portable cords and cables



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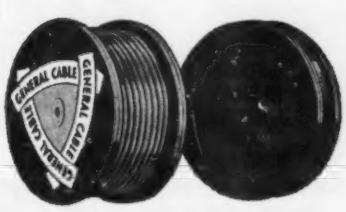

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(Advertisement)

HALL INDUSTRIAL WATER REPORT

Hall Laboratories, Inc.—A Subsidiary of Hagan Corporation, Pittsburgh, Pa.

Volume 2 DECEMBER 1954 Number 6

Close Control Pays Off in Clean Boilers

When Hall Service was started at an East Coast plant, R. A. Beardsley, service engineer, undertook to educate and interest all of the operating personnel in their water conditioning program, so that follow-through on his recommendations for better operation would not be left to "George." In this plant no actual failures had occurred, and because chemical treatment had been used, the personnel was convinced that such troubles as plugging of feed lines, poor distribution of chemicals, and the time and labor consuming cleaning job were necessary evils. The plant men were astonished when minor modifications in pre-boiler control and treatment practices, faithfully carried out, resulted in major improvements in the internal condition of four waste heat boilers.

Tight control now polices chemical treatment and adjustment of the phosphate-silica ratio in the boiler water has eliminated the adherent magnesium phosphate scale that was responsible for the massing of deposits.

Since the plant men had formerly taken it for granted that crowbars, chisels and hard labor were needed to get rid of heavy scale accumulations, washing out the greatly reduced amount of deposit right down to clean metal now seems like child's play.

Foreign Relations

One Hall staff engineer had to travel 8000 miles to go to work recently when a request for consultation came from the Arabian American Oil Company in Saudi Arabia. But setting up water treatment for boiler operation, for the protection of condensate lines and for air conditioning equipment at three plants made A. M. Henricks feel that he had never left home during the five weeks he spent in Arabia. Mr. Henricks' long-distance service job was one of several such trips he has made in the last few years.

Another phase of Hall Laboratories' foreign service is a training course which has been given to engineers and technicians from all parts of the world. Although this training is made available to Hall Laboratories' domestic clients, it is especially valuable to personnel from foreign plants in familiarizing them with the latest in water treatment.

Engineering and Industrial Wastes

In a Panel Discussion on Stream Pollution presented at the Fifteenth Annual Water Conference, H. A. Reda of Hall Laboratories defined "An Engineering Approach to Industrial Waste Problems." Viewing plant process and waste water problems as a part of an integrated program of water use leads to the systematic analysis that constitutes the engineering approach. Mr. Reda pointed out that "bonus" benefits frequently result when the investigator studies the entire water system in a plant in order to set up the most effective and economical treatment of industrial wastes. Recovery of costly process materials, reduction of water consumption, and re-use can help to offset the cost of treatment. In one plant, study of over-all water practices enabled Mr. Reda to reduce the preliminary $250,000 estimate by almost one half.

Mr. Reda's discussion brought out the value of the engineering approach in unraveling the complex waste disposal problems in plants built long before the pollution of streams was a consideration in industrial operations. In many of these older plants, no one actually knows how the piping is laid out. In some, where the water source is located on plant property, no measurement of flow rates has ever been made; probably such a plant would not even have a flow meter. In these plants, only an engineering approach can solve the problems effectively.

Hall Engineer Boosts Employee Morale

The several hundred employees of a glass manufacturing plant complained that hot water in the bath house was extremely hard and much too scarce. The shortage was due to a hard calcium carbonate scale which reduced shell-tube heater efficiency in a matter of days after each cleaning, and defied complete removal by either chemical or mechanical means.

When this unhappy situation was mentioned to Hall engineer W. J. Reese, he thought of the softened, Threshold-treated water used for make-up in the production cooling system in the plant. He pointed out that the blowdown from this cooling system, which had formerly run to waste, could be fed to the bath house heaters, thus eliminating the scale problem. Now everyone is happy . . . employees because they are getting adequate supplies of softened hot water, and management because a troublesome problem was licked without the purchase of costly water softening equipment.

Close Contact Maintained by Hall Executives

Field service engineers of Hall Laboratories get to boss the bosses when the top executives make their regular visits to all of the district offices to maintain first-hand contact with field problems. On such trips, even travel time is utilized for the exchange of information between the headquarters men and field engineers. When J. N. Welsh, Associate Director of Hall Laboratories, made the rounds of the western offices recently, one of his stops was at Nanaimo, where he presented a discussion on Steam Conditioning at a meeting of the Nanaimo Branch of the Institute of Power Engineers.

Water is your industry's most important raw material. Use it wisely.

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AIR CONDITIONING, HEATING, REFRIGERATION AND VENTILATING

1 **Multistage centrifugal blowers** and exhausters for air pressures from 1 to 9 psi or vacuum from 3 to 13 in. of mercury. Photos, design and application data in 12-page bulletin M-103. Air Appliance div, U.S. Hoffman Machinery Corp, 105 4th Ave, New York 3, N. Y.

2 **Cooling tower** performance booklet *Test Your Tower* describes method of pre-determining tower performance before purchase. Photos, charts in 20-page bulletin R-54-P-5. The Marley Co, 222 W Gregory Blvd, Kansas City, Missouri.

3 **Electronic air cleaners** for industrial installations. Cutaways, construction and engr data in 8-page bulletin CB-20. Electro-Air Cleaner Co, 1255 Reedsdale St, Pittsburgh 33, Pa.

4 **Climate changers** used to heat, cool, humidify and dehumidify air as well as filter dust and dirt from the atmosphere. Bulletin DS-303, The Trane Co, La Crosse, Wisconsin.

5 **Convectors.** Full line described in 32-page catalog 703. Photos, diagrams, capacities, dimensions. Airtherm Manufacturing Co, 750 S Spring Ave, St Louis, Missouri.

6 **Electrical heating unit** for operation at temperatures below freezing to 482 F. Diagrams, applications, construction data in 8-page bulletin *Heatflex*. Continental Electric Equipment Co, Box 1055, Cincinnati 1, Ohio.

7 **Finned cooling coil** for refrigeration systems. Photos, dimensions, engr data in 4-page bulletin 158. Frick Co, Waynesboro, Pa.

BOILERS AND AUXILIARIES

8 **Side dump stokers** with moving grates. Photos, construction data in 6-page bulletin. Riley Stoker Corp, Worcester, Mass.

9 **Gas burners,** nozzle mix type, *Model E*. Diagrams, specs in 2-page bulletin 177. Preferred Utilities Manufacturing Corp, 1860 Broadway, New York 23, New York.

10 **Steam generating** and fuel burning equipment, for public utility and industrial power and heating plants. Photos, descriptions of boiler units, gas burners, stokers in 4-page bulletin. Riley Stoker Corp, Worcester, Mass.

COMPRESSORS AND ACCESSORIES

11 **Two-cylinder compressors,** designed for public utility service, rated at 105 cfm. Specs, mounting data in 4-page bulletin C-10-A. Le Roi Co, 1706 S 68th St, Milwaukee 14, Wis.

12 **Air compressors.** Full data on company's complete line. Photos, specs, fittings and accessories in 28-page bulletin C-100. Curtis Pneumatic Machinery div, Curtis Manufacturing Co, St Louis 20, Missouri.

ELECTRICAL CONTROLS

13 **Stepping relays.** Photos, dimensional drawings, technical chart data in 12-page bulletin P-54. Guardian Electric Manufacturing Co, 1621 W Walnut St, Chicago 12, Illinois.

14 **Actuators** for remote control of all types and sizes of wrench-operated plug valves from 1 to 8 in. Photos, applications, detailed line drawings in 8-page bulletin. Pantex Manufacturing Corp, Pawtucket, Rhode Island.

15 **Temperature control** for applications to 1800 F. Details, specs in 2-page bulletin 104. Burling Instrument Co, Inc, 16 River Road, Chatham, New Jersey.

16 **Voltage regulators.** Booklet 3090 contains technical data of *Type JB 1/1* and *JBG 1/1* units for ac generators rated from 20 to approximately 438 kva. Booklet 3095 describes *Type JB 1/1* regulators for generators rated from 438 to approximately 1175 kva. Specify bulletin desired by number. Brown Boveri Corp, 19 Rector St, New York 6, New York.

(*Continued on page 218*)

Here's why the Ljungstrom saves fuel...improves boiler performance

1

1. Saves Fuel — Savings are roughly 1% for every 45-50°F of preheat, since this heat has been recovered in usable form from flue gases.

2

2. Increases Boiler Output — Preheating combustion air increases boiler furnace temperature. Heat absorption into boiler tubes increases at the same time, raising the unit's capacity to produce steam.

3

3. Increases Boiler Reliability — Preheating leads to more complete combustion of fuel; therefore, less slagging. By burning fuel more completely, it helps boilers stay on the line longer. Furthermore, gases to dust recovery units are cleaner.

4

4. Permits Use of Lower Grade Fuels — Saw and paper mill refuse, wood, lignites, peat, bagasse and similar low-grade fuels become commercially practical when preheated combustion air is used.

The Ljungstrom® Air Preheater . . . used in seven out of ten large boiler installations—is the most compact, reliable and versatile preheater available. Installed in a boiler, it leads to the four well-known advantages listed at the left.

Remember: the ability to deliver these important benefits in full measure is an important reason why more than twice as many Ljungstrom Air Preheaters are specified for large boilers than all other types combined.

WHEREVER YOU BURN FUEL, YOU NEED LJUNGSTROM

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

George Edwards' Scrapbook

Plenty hot in earth's center

Whatever happened to all that talk about tapping a deep hole into the earth to bring out heat energy? Remember the stack of technical papers read on the subject about 20 years ago?

It does seem strange that we have to worry about bits of fuel deposited in the earth's crust when the earth's core is supposed to be superheated metal. The average increase in temperature as you bore into the earth is 1 F for every 60 feet, or about 90 F per mile.

Dr Grunsky theorized years ago that if we could bore deep enough to reach the superheated iron, we'd have a gigantic boiler, the "steam" being a gaseous iron instead of gaseous water. As a starter, some engineers believed a hole 10 miles deep was enough to make the project worthwhile by absorbing heat directly from earth. Any ideas?

Is living really tough?

To maintain oneself on this earth is not a hardship but a pastime, if we live simply and wisely. —*Thoreau*

Relax and live longer

With engineers and other hard-working people often passing away before their time, you might be interested in the recommendations of the Relaxation Club of America, 145 East 52nd St, New York, N. Y.

Here are their rules: (1) Take a leisurely lunch hour. If there's a sofa in your office, steal 40 winks. (2) Never sit straight and rigid while phoning. In the office, put your feet on the desk. At home, lie down. (3) At a party, don't try to be entertaining every minute. Eat and drink slowly and leave when bored. (4) Don't ever run for a bus. Chances are it'll start just as you reach it. (5) Relax while driving. Drown out back-seat drivers by turning the radio loud. (6) Watch TV lying down. If you fall asleep, so much the better. (7) Don't discuss controversial subjects. Merely say, "Do you really think so?" and you'll never get involved. (8) If you find playing bridge is nerve-wracking, change to Scrabble. (9) Finally, don't run if you can walk; don't walk if you can sit; don't sit if you can lie down.

If interested, you can join the club by writing them.

Smart people don't argue

Preserve an open mind on all debatable questions. Discuss, but do not argue. It's a mark of superior minds to be able to disagree and yet to be friendly with everyone.

Head machinist Henry Ford

DID YOU KNOW that the late motor magnate Henry Ford once worked as an engineer at Detroit's first central power station, now restored in Greenfield Village, a suburb of Detroit? Edison Illuminating Co was Detroit's only incandescent lighting station then.

Ford, with handle-bar mustache, is at extreme right in the photo. He started as an operator, at a salary of $40 a month, but before long advanced to a higher position. After successfully repairing a Beck steam engine, he was made head machinist, and later chief engineer. He was with the company from 1891 to 1899. During that period he spent most of his spare hours working on ideas for his first gas-powered car.

Some of the original equipment in the restored power station in the Village includes two Armington & Sims steam engines, old dynamos and the Beck engine repaired by Henry Ford. Original boilers are also there.

All ancient machinery in the Illuminating Co building is in operating condition and you power engineers will find it an interesting place to visit with your families.

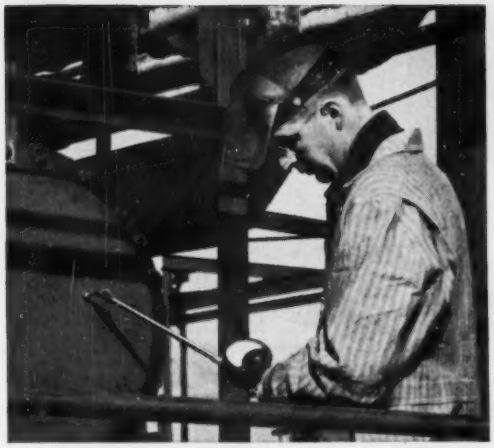
Bible teaches clear writing

If you want to learn to write clearly and simply, one suggestion is to read *Tell Freedom* by Peter Abrahms, the South African Negro poet and writer. In this new book, there is not one big word, not one clumsy sentence—and I have reason to believe you'll enjoy this prose collection besides. At least I found it worth reading.

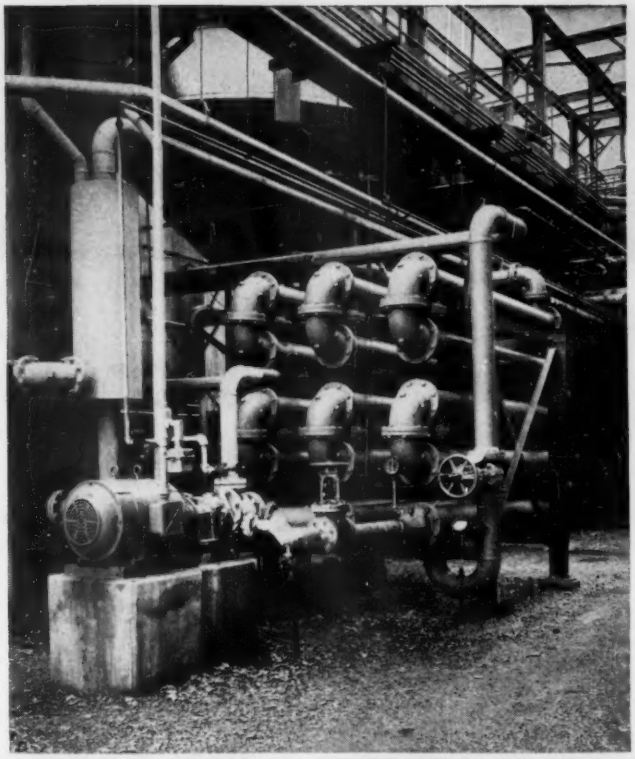
When asked how he learned to write such easy-to-read English, Abrahms answered, "Whenever I used big words or made clumsy and almost meaningless sentences, my missionary teacher sent me to the Bible." So he advises; "If you want to see how good English should be written, read the Bible."

The Bible also helped Abe Lincoln to write clearly.

George Edwards
Engineer



Experienced engineers are at your service day and night. They diagnose the trouble, prescribe and administer the cure for maintenance cleaning problems.



Dowell's specially equipped trucks provide all the necessary equipment for modern chemical cleaning operations. Solvents are applied according to the technique demanded by the job: filling, spraying, jetting, cascading or vaporizing.

NO SHUTDOWN FOR CLEANING

Scale removed chemically from caustic tanks and coolers while units continued to operate. Full capacity restored.

Time and time again Dowell Service has proved that industrial equipment—heat transfer units, boilers, tanks—can be cleaned quickly and effectively with chemicals. Take this case for example. Dowell was called in to clean some caustic cooling tanks and coils for a large chemical company. A reduction in cooling capacity and an increase in input pressure indicated the equipment had become clogged with scale. Sea water had been run through these coils as the cooling agent, leaving iron and chloride deposits.

Dowell engineers pumped specially prepared liquid solvents into the units through regular connections—without dismantling. No scaffolding was necessary. Caustic production was continued during the job. Operations were curtailed only slightly. The tanks and coils were restored to full cooling capacity in less than 18 hours.

Whatever your cleaning problem—piping systems or process equipment—call a Dowell engineer. He will be glad to work with you—no obligation. For consultation, contact your nearest Dowell office or write to DOWELL INCORPORATED, Tulsa 1, Oklahoma, Dept. L-23.

DOWELL SERVICE

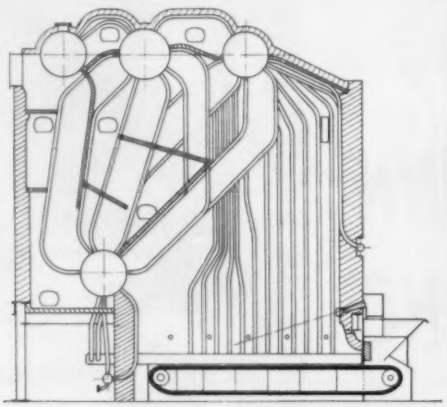
chemical cleaning service for industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

77% GREATER CAPACITY WITH LACLEDE CHAIN GRATE STOKER

SAME BOILER IS USED— UNDERFEED STOKER IS REPLACED



LACLEDE CHAIN GRATE STOKER

The Bunte Brothers Chase Candy Co., Chicago, Illinois, were producing a maximum of 36000 #/hr steam with a boiler fired by an underfeed stoker.

Because a recent installation of a Laclede Chain Grate Stoker in the same plant was operating much more satisfactorily, it was decided to replace the underfeed stoker with a Laclede Chain Grate Stoker. No other changes were made in the installation.

The new Laclede Chain Grate Stoker firing the same boiler has already easily produced 64000 #/hr steam — an increase of over 77%.

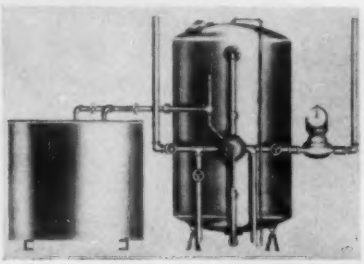
FOR MOST EFFICIENT BURNING OF MID-WEST BITUMINOUS COALS USE LACLEDE CHAIN GRATE STOKERS.

LACLEDE STOKER COMPANY
4440 HUNT AVE. • ST. LOUIS 10, MO.

Founded in 1904

More EQUIPMENT NEWS

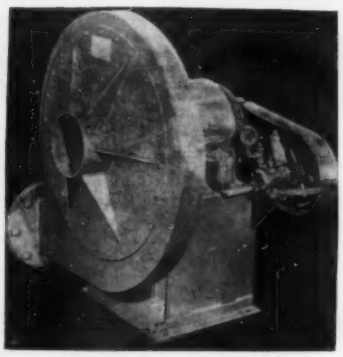
Begins on page 172



Zeolite water softeners

1251 • Units are individually designed to meet particular size and capacity requirements for soft water in food and processing plants, power plants, etc. Available as manual or automatic units. In automatic operation steps of backwashing, brining, rinsing and return to service are carried out without operator's attention. In semi-automatic operation initiation of regeneration cycle is controlled by push button. Bulletin 211.

Industrial Filter & Pump Mfg Co, 5900 Ogden Ave, Chicago 50, Ill.



Turbo-pressure blowers

1252 • Units furnish air at high pressures for use with oil and gas burners on industrial furnaces, for scale blowing and air curtains. Available in single and double inlet fans, direct or belt driven, units maintain constant pressure while supplying varying volumes of air. Front and back plates are braced with gusset plates claimed to eliminate transmissional vibration and "breathing" and make these fans quietest in the high pressure field. Units are designed to deliver their rated capacity when operating at 3450 rpm. For air pressures from 4 oz to 24 oz.

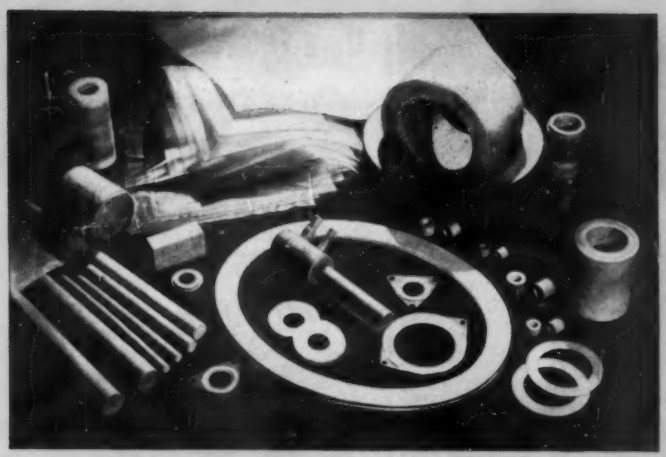
Chicago Blower Corporation, 9867 Pacific Ave, Franklin Pk, Ill.

For more data on these items, use post cards p 181. Identify your request with item number.

Multichannel oscillographs

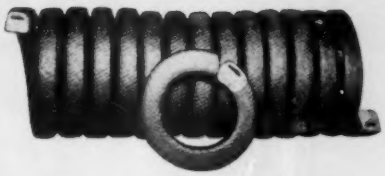
1253 • Multichannel direct-wiring oscillographs feature 4 and 6 channel systems. An electrically controlled chart drive system permits instant speed selection. Sixteen accurate chart speeds are possible, from one cm per hr to 250 mm per sec.

All oscillographs can be mounted on roller slides in a standard 19 in. rack or



TEFLON

PUMP VALVES

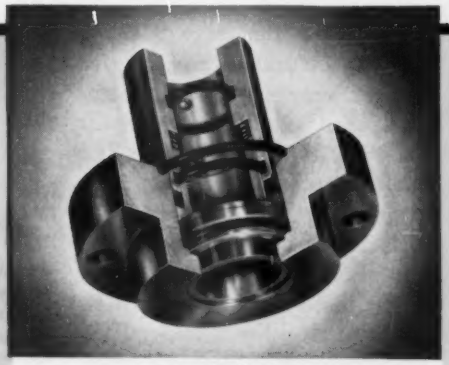


HIGH PRESSURE PACKINGS

SOFT BRAIDED ASBESTOS PACKING

HYDROIL

"THYRIL"



ANK RITE

ALL THIS AND MORE TOO! AT BOOTH 239

What's today's best problem-solver in fibrous and metallic packings? See the answer at Booth 239 at the POWER show!

Much of interest in the way of what, why, and how to select the right packings will be on display at the Anchor Packing Company booth . . . so don't miss it! You are cordially invited.

DISTRICT OFFICES

BALTIMORE, MD.	DETROIT, MICH.	NEW YORK, N.Y.
BOSTON, MASS.	HOUSTON, TEX.	PHILADELPHIA, PA.
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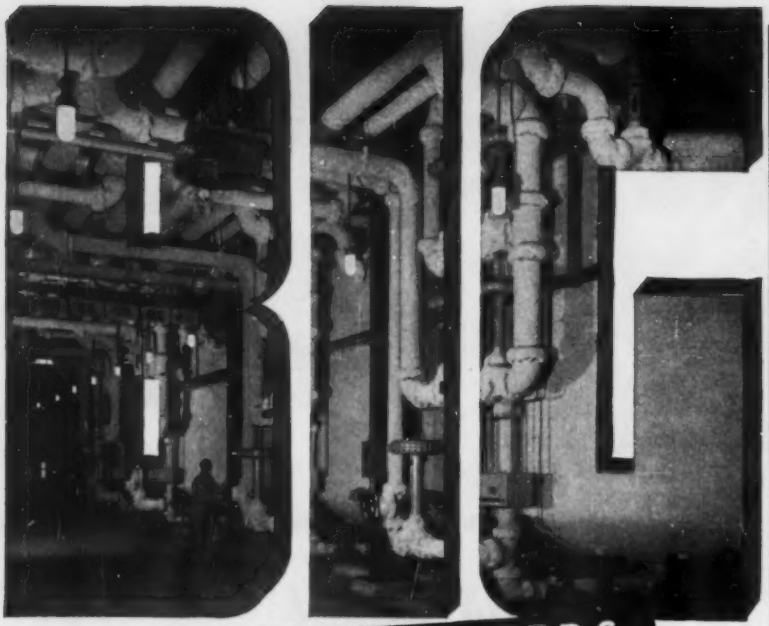
DAYTON, OHIO	NEW ORLEANS, LA.	ST. LOUIS, MO.
TOLEDO, OHIO	WILMINGTON, CAL.	

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.

FACTORIES: MANHEIM, PA. ELKHART, IND. MONTREAL, CAN.

FIBROUS AND METALLIC PACKINGS FOR EVERY INDUSTRIAL PURPOSE



DEMINERALIZERS

USE

Nalcite® ION EXCHANGE RESINS

(DOWEX*)

THIS demineralizer, one of the world's largest, provides 100% makeup for 1250 psi boilers generating 1,200,000 pounds of steam per hour. Using Nalco ion exchange resins, Nalcite HCR® and Nalcite SAR, silica is successfully removed from the feedwater — as illustrated by the fact that after 75 to 100 concentrations, silica content of the boiler water is still *less than 5 ppm!*

In demineralizers large or small, Nalcite ion exchange resins give top performance. They are chemically and physically stable for long life at top efficiency. *Two* Nalcite anion exchangers . . . your choice of SAR or SBR . . . are available to meet the conditions of your water supply. Either, used with Nalcite HCR, offers top quality demineralized makeup for high pressure steam generators.

*Reg. Trademark of The Dow Chemical Company.

DATA ON SILICA REMOVAL

A new edition of Nalco Bulletin 57 gives technical data on Nalcite SAR and Nalcite SBR anion exchangers . . . includes complete up-to-the-minute information on silica removal. Write for your copy today.

NATIONAL ALUMINATE CORPORATION

6222 West 66th Place • Chicago 38, Illinois

In Canada: Alchem Limited, Burlington, Ontario

Nalco®

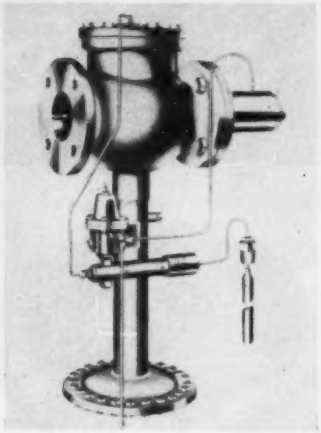
PRODUCTS • *When you use Nalcite resins, you take advantage of Nalco's long and broad experience in water and process technology.*

More EQUIPMENT NEWS

Begins on page 172

furnished in a console for operation on a bench or cart. Both ink writing and combination ink and electric writing units are available, which record static and dynamic phenomena from dc to 100 cps.

Brush Electronics Co,
Equipment Dept RT-1,
3405 Perkins Ave, Cleveland 14, Ohio



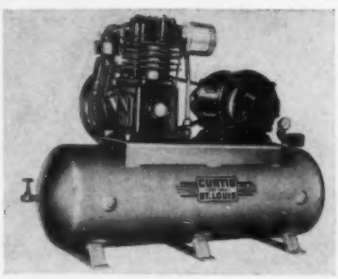
Temperature, pressure valve

1225 • Single main valve gives both temperature and pressure control to prevent hunting, cycling or overheating that sometimes occurs with a temperature control alone. Valve is set to meet maximum demand of the system pressure-wise. Pressure reducing function operates in this way: downstream pressure is sensed by pilot valve that opens or closes to maintain set pressure. This action is supplemented by temperature control pilot that shuts main valve when temperature control point is reached. This closing occurs regardless of downstream pressure. When control temperature falls below set point, main valve opens and the pressure reducing function resumes automatically.

Pressure range is 5 to 125 psi. Temperature adjustment range is 50 F. Full details on request to manufacturer.

Klipfel Valves Inc, Hamilton, Ohio

For more data on these items, use post cards p 181. Identify your request with item number.



Air compressors

1229 • Completely new line of air compressors, available in sizes from ¼ to 50 hp (300 cu ft per min), can be furnished either vertical or horizontal, tank- or base-

Two Reasons why
CHAPMAN
STEEL VALVES
Keep Maintenance Low in High Pressure Service

Carefully-formulated alloys and *accurately-detailed contours* give Chapman Steel Valves unexcelled dependability under the most severe high pressure and high temperature conditions.

Fourteen alloys are made in Chapman's own foundry, under rigid laboratory supervision, to ensure that every valve is made of the right steel for its specific service.

Precision manufacture to close tolerances is *standard* in Chapman Steel Valves. Designs have been refined to meet the demands of years of smooth operation at minimum maintenance costs. Quality is unsurpassed.

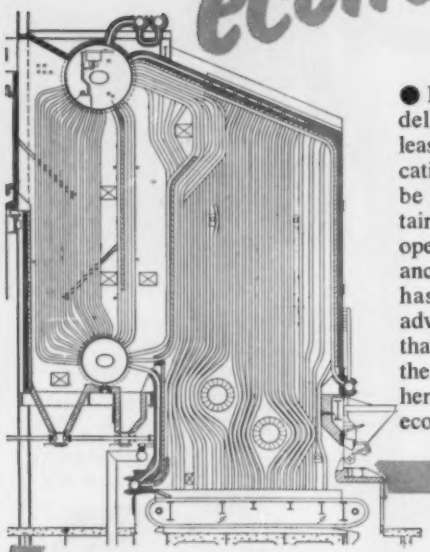
For gates, globes and checks in all pressure classes — 150, 300, 400, 600, 900, 1500 and 2500 psi — and for temperatures to 1150°F, see Chapman first. Valves are supplied with welded, pressure seal or bolted bonnet joints and with flanged or welding ends. Valves equal or exceed ASA standards in every range.

Write for Catalog 20.

THE CHAPMAN VALVE MANUFACTURING COMPANY
INDIAN ORCHARD, MASSACHUSETTS

WHAT MAKES A BOILER *truly economical?*

★ ★ ★



● Basically, it's the ability to deliver the most steam for the least money in a specified application. To do this, a boiler must be designed to bring you sustained high efficiencies over long operating periods. Such performance is possible only if the boiler has basic design features and advantages that all work toward that end. See, for example, how the Bros design features listed here combine to produce true economy of operation:

VERTICAL DESIGN

Bros uses a vertical arrangement of watertubes and baffles to sharply reduce clinging of soot or fly ash. A cleaner boiler means more rapid heat transfer!

LONG GAS TRAVEL

Bros elongated gas travel means that all possible energy is wrung from the gas and converted to steam. The results are low gas exit temperatures and sustained high efficiencies!

LOW OVER-ALL HEIGHT AND LARGE FURNACE VOLUME

Through compact vertical design of elements, Bros offers a large furnace volume within conservatively low over-all height. Space is utilized most effectively. A Bros boiler gives you maximum furnace volume and maximum flame travel per foot of over-all height!

LARGE HYDROSTATIC HEAD

Since you can't expect effective heat transfer from tubes to sluggishly moving water, Bros provides a large hydrostatic head which circulates water at greatest practicable velocities.

RAPID CIRCULATION

Rapid circulation of water in a Bros boiler means cooler tube surfaces, an important safety factor. And rapid circulation is a factor which directly contributes to consistently high efficiencies!

NEW TECHNICAL LITERATURE AVAILABLE

For more detailed descriptions of economical Bros watertube boilers and stokers, write for any of these technical folders: (A) Watertube Boilers; (B) Packaged Boilers; (C) Spreader-type Stokers; (D) Continuous Ash Discharge Stokers.

BROS POWER DIVISION

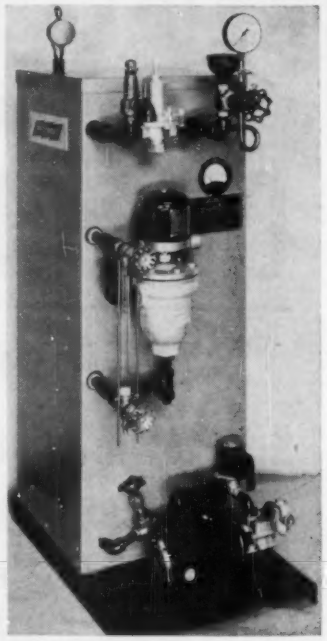
WM. BROS BOILER & MFG. COMPANY • 1057 10th AVE., S. E., MINNEAPOLIS 14, MINN.

More EQUIPMENT NEWS

Begins on page 172

mounted, or as a basic unit. The manufacturer states that redesigned and enlarged cooling fins produces greater cooling area. All units have pressure lubrication systems consisting of only one moving part—the oil pick-up ring that revolves on the crankshaft. Complete information on request.

Curtis Pneumatic Machinery Division of Curtis Manufacturing Company, 1905 Kienlen Ave, St Louis, Mo.



Electric steam generators

1231 • Unit features built-in self-regulating control that, without pressure switches or magnetic contactors, continuously and automatically regulates input of electric power to exactly balance steam load. According to manufacturer, units require approximately ½ sq ft of floor area per boiler hp. Safety features claimed include freedom from gases, flame or fire hazards. Available in standard sizes from 1½ to 60 bhp and pressures to 500 psi.

Livingston Engineering Co, 100 Grove St, Worcester 5, Mass.

For more data on these items, use post cards p 181. Identify your request with item number.

Industrial truck battery

1254 • This battery supplies more capacity relative to its size than any *Edison* nickel-iron-alkaline storage battery heretofore available, manufacturer states. *Type MC* can supply most driver-ride sit-down type trucks with as much as 25% more capacity than other types of *Edison* batteries without changing either steering-wheel or pedal heights and without increasing either length or width of battery boxes.

Cells of *MC-type* battery employ standard steel-tube and pocket construction of plates. They are identical in electrical characteristics and ratings. The *MC* cell is now

You Get Time-Tested Dependability With

VISIT BOOTH 335

NAVCO Counterpoise*

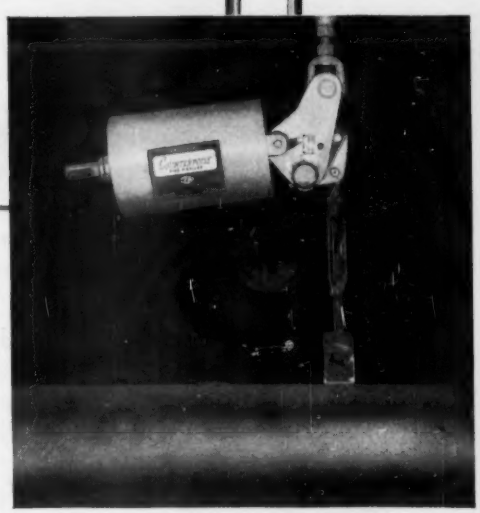
Pipe Hangers

The constant load-carrying capacity of Navco Counterpoise* Pipe Hangers has been proven during an extended period of satisfactory service as the first accurate and efficient support for high temperature piping systems. They are being used extensively in steam generating stations, refineries and chemical plants.

The Counterpoise Hanger is a spring-actuated counterbalance. An ingenious system of linkage transforms the varying force of the spring in an accurate mathematical ratio to produce a load supporting effort of constant value throughout the entire range of expansion travel.

The design permits great flexibility of installation and saves valuable space in congested areas. All parts are ruggedly made and have a high safety factor, yet excess weight and oversize physical dimensions have been avoided to hold space and structural load requirements to a minimum.

The Navco Counterpoise Hanger is available in 16 different frame sizes with load capacities ranging from 200 to 16,000 pounds and expansion travels up to 12 inches. For detailed information on how you can get dependable support with this unique hanger, write today for our 12-page illustrated bulletin #153.



Note above how the flexible top connection permits the hanger assembly to fall in line with the direction of the load pull, so that horizontal travel of the piping has no appreciable effect on the hanger operation. The unit may be positioned at any angle. This affords flexibility in installations where close clearances are a factor.

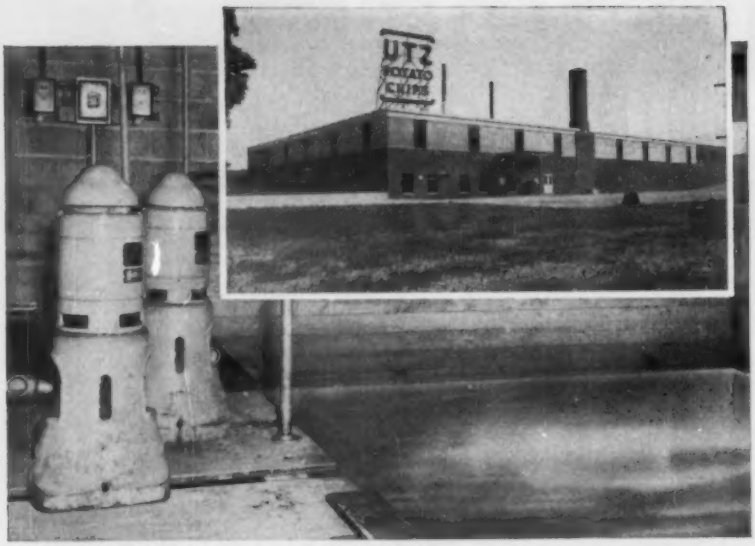
** Counterpoise is a trade name of the National Valve & Manufacturing Company*

NAVCO

NATIONAL VALVE & MANUFACTURING COMPANY

3105 LIBERTY AVENUE, PITTSBURGH 1, PENNSYLVANIA

New York • Chicago • Cleveland • Boston • Atlanta • Buffalo • Cincinnati



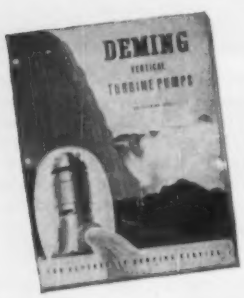
Deming Turbine Pumps Perform Dual Service

Separately or Together

Pure spring water is used in processing those tasty chips produced by the Utz Potato Chip Company, Hanover, Pa. Purity of the water supply is evidenced by its acceptance by the Pennsylvania State Health Department. The same cool spring water is used for air conditioning units in the modern plant.

Purity of the water is protected with two Deming Vertical Turbine Pumps. Those water-lubricated units assure that the water supply will not be contaminated by oil or grease as none is used.

The two pumps can be operated as one unit, or separately, as required, for processing and air conditioning service. This is another example of the adaptability of Deming Vertical Turbine Pumps for a wide variety of applications.



Send for Bulletin 4700

This 24-page, fully illustrated bulletin explains the construction features and many of the more widely used applications of Deming Vertical Turbine Pumps. Unit drive heads are built in a range of sizes with motors from 1 to 250 H.P. Capacities range to more than 3,500 G.P.M.

THE DEMING COMPANY
547 BROADWAY • SALEM, OHIO

DEMING PUMPS

More EQUIPMENT NEWS

Begins on page 172

produced in six sizes with capacities from 285 amp-hr to 710 amp-hr. Standard assemblies range from 10-cell, rated capacity 3.42 kwhr, to 42-cell, rated capacity 35.78 kwhr. Complete details on request.

Thomas A Edison, Inc,
Edison Storage Battery Div,
West Orange, N. J.

Lightweight safety suits

1227 • Safety suits are made of flame resistant fabric fused to metallic layers, topped with specially treated aluminum foil. Manufacturer states that body temperatures recorded under *Fyre-Armor* suits remain normal even in high radiant heat of 2500 F. Hoods allow 180 deg visibility and permit use of breathing equipment. Available in 10 models weighing from 5 to 10 lbs. Details on request.

Far-Ex Corp, 75 West St,
New York 6, New York

For more data on these items, use post cards p 181. Identify your request with item number.

Self-balancing indicator

1255 • Unit makes it possible to read or log several temperatures quickly and accurately. Indicator can be connected to several hundred thermocouples or resistance bulbs through connector panels, toggle switches or rotary switches. If switches are used they are housed in separate case. Available in 23 different ranges from –320 to +200 F and up to 0 to 3000 F. Write for bulletin 61 for complete information.

Thermo Electric Co, Inc, Saddle River Twp, Rochelle Park PO, N. J.

Feedwater control systems

1221 • One, two and three element feedwater control systems are offered to meet requirements of large, medium or small boilers under normal or most severe operating conditions. Present instruments can be utilized for pressures to 2500 psig. Electronic operation of controller provides great speed of transmission and high accuracy of control, according to manufacturer. Controller is independent of effects due to normal variations in voltage and frequency. Features include: positive valve drive; mercury-less measuring and transmission for

HOW ACCURATELY DO YOU MEASURE

EXCESS AIR

IN YOUR FLUE GAS?

Prevent heat loss up the stack. Too much or too little excess air means big money in today's boiler plant. It's important to *know* and *control* excess air exactly—regardless of load or fuel changes.

Burn multiple fuels efficiently

When switching from one fuel to another or burning more than one fuel at the same time, only an Oxygen Recorder gives you an undistorted picture of excess air. It measures O_2 directly and continuously, without recalibration.

Hundreds of companies are reaping large savings with Hays Electronic type Oxygen Recorders in their boiler plants. Flue gas sampling systems fit a wide variety of installations.

With the Hays Electronic type Oxygen Recorder you get continuous, highly accurate indication and recording . . . complete compensation for temperature and pressure effects . . . freedom from chemicals or hazardous fuel burning in the analyzing process . . . swift, sure electronic operation.

Write today for Hays Bulletin 52-829-56. Also ask for a dramatic comparison graph which shows that the relationship between O_2 and excess air is practically constant for different fuels.

Automatic Combustion Control
Boiler Panels • CO_2 Recorders
Veriflow Meters and Veritrol
Gas Analyzers • Draft Gages
Combustion Test Sets
Electronic Oxygen Recorders
Electronic Flowmeters
Electronic Feed Water Controls
Miniature Remote Indicators

THE hays CORPORATION

MICHIGAN CITY 3, INDIANA

ROTOJET®
Tube Cleaners

Clean tubes and pipes from ½" to 12" I.D. THOROUGHLY QUICKLY

ROTOJET Model 512 Air-driven Motor, universal joint, swing-frame head, and solid brush.

Our large stock of Rotojet air-driven and water-driven tube cleaners, accessories, and repair parts for straight and curved tubes, pipes, and transfer lines is available to meet most requirements without delay. Tube cleaner specialization for 43 years assures satisfactory results from any Rotojet equipment we recommend. Send for Bulletins J-410 and R-105. For quick action wire or phone, HUmboldt 3-0570.

ROTOJET Model C-526 Air-driven Motor with pivot head and universal joint.

ROTOJET Model C-525 Air-driven Motor with swing-frame head and universal joint.

ROTOJET Junior Model S32 Air-driven Motor, universal joint, cone cutter.

ROTOJET Junior Model C434 Air-driven Motor flexible coupling, expanding brush.

ELLIOTT COMPANY-ROTO DIVISION

153 SUSSEX AVE. • NEWARK 1, N. J.

More EQUIPMENT NEWS

Begins on page 172

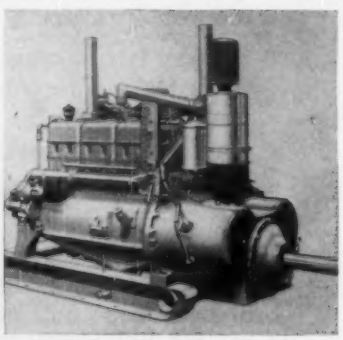
flow and level; independent adjustments for effects of steam flow, water flow and water level; no blow-down necessary. Request publication 54-1073-221 for details. **The Hays Corp, Michigan City, Ind.**

Final drive unit

1256 • High torque final drive unit for positioning fans and valves in outdoor boilers, heavy doors and other equipment in steel mills. Weatherproof housed unit is capable of exerting starting torque in excess of 4000 lb ft. Pneumatically powered, it may be equipped to receive either pneumatic or electric control signals from an automatic source or manually operated control panel. Rotary shaft output with 60 deg travel simplifies linkage since a push-pull motion is available at any angle in increments of 45 deg about the shaft. Stroke can be varied by varying lever length. In case of air failure, unit is locked automatically in its last control position. Lock is automatically reset when air pressure is restored. Full details in company's specification folio S-19.

Republic Flow Meters Company, 2240 Diversey Pkwy, Chicago, Ill.

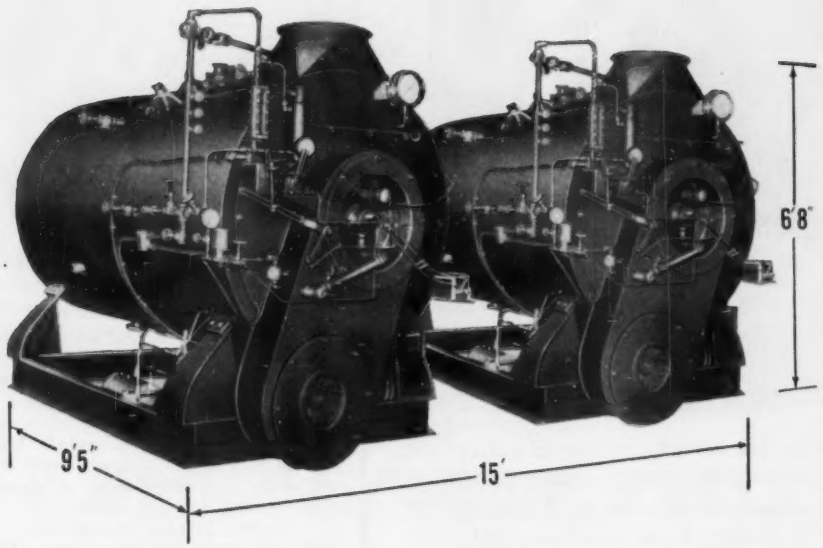
For more data on these items, use post cards p 1-11. Identify your request with item number.



Industrial power unit

1257 • High horsepower in the range from 252 to 290 is provided in this heavy-duty industrial power unit that operates with 12 v on either natural or LP gas. Dual six-cylinder engines mounted in parallel are geared to single power take-off

9600 lbs. of Steam in only 1000 cu. ft!



Using only 140 sq. ft. of Floor Space

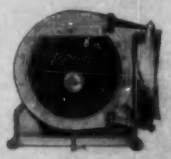
The Cyclotherm MC4000 Steam Generator allows you to utilize your space more efficiently . . . to devote more of your area to storage and production use.

Requires the minimum in boiler room space and costs. Or can be placed in a working area because radiant heat loss is at a minimum. Exclusive, patented, Cyclotherm Cyclonic Combustion makes the most compact steam generator yet developed possible.

A flaming cyclone swirls the length of the firetube . . . separated from the walls only by a thin layer of air. The even distribution of the flame converts the entire surface of the firetube into an effective heating area. Without increasing the boiler size, the heating area has been enlarged to the maximum.

No other method of combustion can equal this accomplishment. The Cyclotherm MC4000 is ideally suited for service wherever steam is needed but boiler room space is at a premium.

Exclusive, patented Cyclonic Combustion gives you a minimum guaranteed 80% efficiency in only 2 passes . . . a rate unequalled by any other method of combustion.

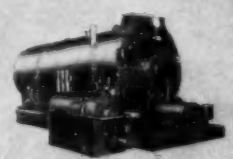


Simplified design shaves maintenance costs up to 50%. Cleaning and replacement of parts can be done in minutes by any maintenance man. Firetube never needs cleaning as all fuel is consumed.

Automatically operates by electronic control system. No fireman required. Burns gas and/or oil. A Cyclotherm unit will pay for itself in 4½ years in fuel savings alone.

Precision modulation equipment regulates firing rate from 30 to 100% of the Cyclotherm's capacity without losing peak efficiency.

Now aboard Sinclair Refining Co.'s "Sinclair Chicago," and U. S. Navy's "U. S. S. Endurance" . . . operating efficiently in space too cramped for ordinary packaged units.



Other Cyclotherm models range from 18 to 500 hp . . . from 15 to 200 psi. For industrial, commercial plants, institutions and marine use.

YEARS AHEAD IN STEAM GENERATION

CYCLOTHERM®

STEAM AND HOT WATER GENERATORS

See Cyclotherm's new MC4000 Steam Generator at the

CYCLOTHERM EXHIBIT

Booth 450, 21st Power Exposition, Philadelphia, Dec. 2-7

Cyclotherm Division, U. S. Radiator Corp., Dept. 374, Oswego, New York

For BOILER BLOW-OFF Safety

Standard Quick-Operating Everlasting Valve

Everlasting Y Valve

Everlasting Angle Valve

These Everlasting Valves are assuring safety in boiler plants all over the country. Each type is stoutly built, with ample strength, resistance to wear, and lasting tightness. Angle and Y designs have interchangeable parts for each size. The three types can be arranged in any combination as Duplex Boiler Blow-Off Units. All Everlasting Boiler Blow-Off Valves conform with ASME Codes, and are available in a range of sizes for pressures up to 600 psig.

Two of the many available combinations of **EVERLASTING** *Duplex Boiler Blow-Off Units*

Write for descriptive Bulletin

EVERLASTING VALVE CO., 45 Fisk Street, Jersey City 5, N. J.

Everlasting Valves

TRADE MARK EVERLASTING REG U S PAT OFF

EV382

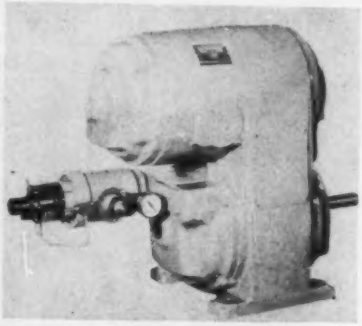
for everlasting protection

More EQUIPMENT NEWS

Begins on page 172

shaft. Displacement is 1600 cu in. Bore and stroke are 5 5/16 x 6 in. Primarily designed for irrigation pumps and other large-volume pumping applications.

Minneapolis-Moline Company, Box 1050, Minneapolis 1, Minn.

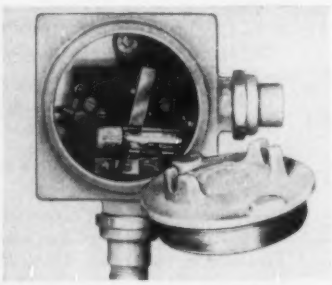


Automatic speed control

1258 • Pneumatic control for the *Speed-Trol* variable speed transmission provides automatically controlled drive for processing operations involving variables such as pressure, temperature, liquid level, proportional flow and control of rewind. Available in manual and automatic types that are sensitive to many types of electric, mechanical or pressure signals.

Sterling Electric Motors, Inc, 5401 Telegraph Rd, Los Angeles, Cal.

For more data on these items, use post cards p 181. Identify your request with item number.



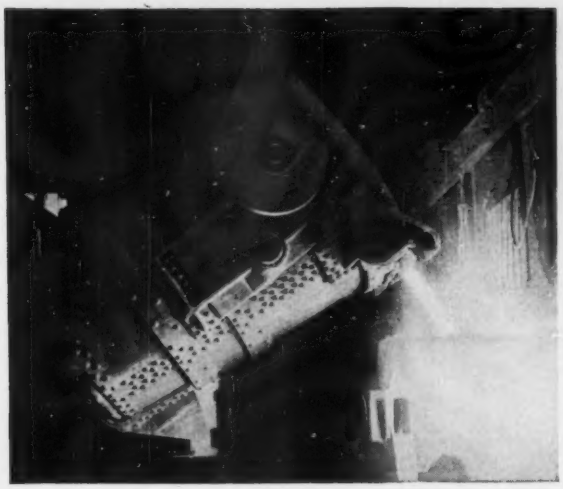
Cooling tower safeguard

1235 • Combined vibration cut-off and safety-switch for cooling tower fans is claimed to prevent tower repairs resulting from blade breakage and equilibrium loss on fans. Sensitive mercury switch automatically cuts off the electric current when vibration indicates trouble. Sensitivity is set by manual adjustment. Switch is operated from cooling tower deck without entering fan stack. Full details on request.

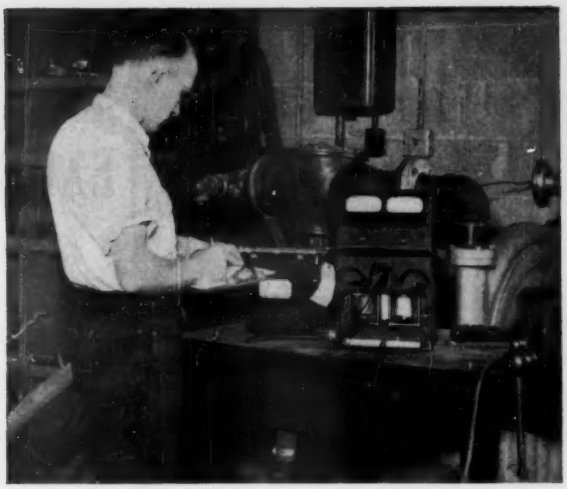
Santa Fe Tank & Tower Co, Inc, 5401 S Boyle Ave, Los Angeles, Calif.

Automatic conveyor lubricator

1259 • Automatic conveyor lubricator injects either grease or oil. *Model 702* lubricates one side of the conveyor only; *Model 704* lubricates both sides of a mono-rail conveyor. Unit can handle a wide range of lubricants from light oil to heavy fiber



STEEL OUTPUT INCREASED BY 110 TONS PER DAY REPORTS STEEL PRODUCER: Tap-to-tap time reduced from 18 to 12 hours . . . Fuel cut 46% per ton produced . . . Tonnage up 50% daily! That's the job Cities Service Heat Prover helped perform for one of the largest steel producers.



"COMPLETED 30 HOUR TEST IN JUST 6 HOURS!" "We completed what normally would have been a 30 hour test in just 6 hours," writes the Eclipse Fuel Engineering Co. of Rockford, Ill. "We found the Heat Prover equally exact, perhaps more exact than standard commercial testing equipment."

INDUSTRY REPORTS ON FURNACE OPERATION:

PRODUCTION UP, COSTS DOWN WITH CITIES SERVICE HEAT PROVER

THE CITIES SERVICE HEAT PROVER . . . Not an instrument that you buy . . . but a service we supply . . . FREE!

Shown above are just two of the many outstanding accounts of the Heat Prover's impressive accomplishments. Wherever a furnace operation is involved, the Heat Prover can help increase productivity by providing:

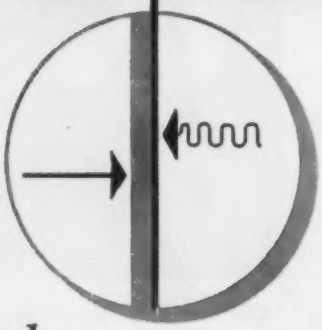
- **Rapid, continuous sampling**
- **Simultaneous reading of oxygen and combustibles**
- **Direct measurement of oxygen and combustibles**
- **Easy portability**
- **Free maintenance and re-calibration service**

Learn how the Heat Prover, supplied and maintained free by Cities Service, can benefit you. For details, contact your nearest Cities Service office or write: Cities Service Oil Company, Sixty Wall Tower, New York City 5, N.Y.

CITIES SERVICE
QUALITY PETROLEUM PRODUCTS

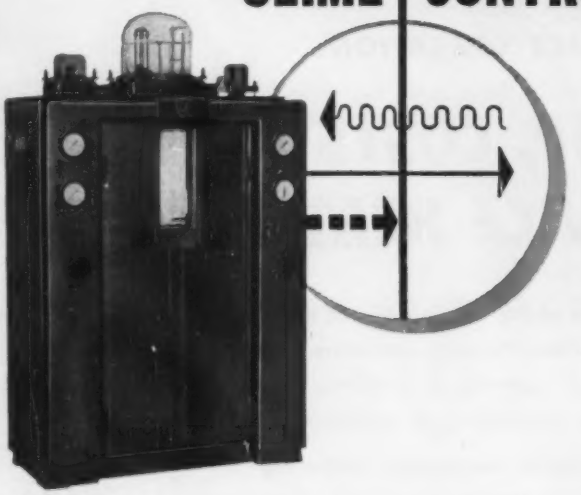
Where you need

HEAT | EXCHANGE



Be sure you have

SLIME | CONTROL



Whether you heat or cool water for make-up, process or any other use, you will need Wallace & Tiernan Chlorination to help combat slime problems introduced by water-borne bacteria or air-borne bacteria.

With slime control equipment designed for any need, built for lasting and dependable service, highly accurate and backed by over 40 years of successful application experience, Wallace & Tiernan Chlorination can help you increase the efficiency of your plant and cut operating costs. For further information write our Industrial Division.

WALLACE & TIERNAN

25 MAIN ST., BELLEVILLE 9, N. J.

CHLORINATORS • CHEMICAL FEEDERS • SCREENING EQUIPMENT • MAGNETIC SEPARATORS • PRECISION PRESSURE INSTRUMENTS • CATHODIC PROTECTION • FINE CHEMICALS

CD-39

More EQUIPMENT NEWS

Begins on page 172

greases. It is self-contained, mounted on the trolley rail and actuated by moving conveyor.

As a trolley wheel approaches the lubricator, the hub engages a nozzle of the pumping unit which is then automatically brought into contact with the grease fitting. Trolley wheel carries the nozzle with it and when nozzle is pointing straight at the trolley, a measured amount of lubricant is discharged under pressure into the wheel bearings.

A 12 lb reservoir and an air control panel are standard equipment. The *70 Series* requires only compressed air for its operation. Each pumping unit is completely adjustable as to quantity of lubricant discharged into each wheel bearing; range 0 to .1 cu in. Complete details on request.

J N Fauver Co, Inc,
51 W Hancock, Detroit 1, Mich.

Anti-noise helmet

1260 • *Sound-Absorb* helmet is designed for use in engine test cells or wherever ambient noise level approaches the threshold of pain. Accommodations for standard intercommunication earphones allow clear hearing in ambient noise levels of 150 db. Further details on request.

Bill Jack Scientific Instrument Co,
PO Box C-17, Solana Beach, Calif.

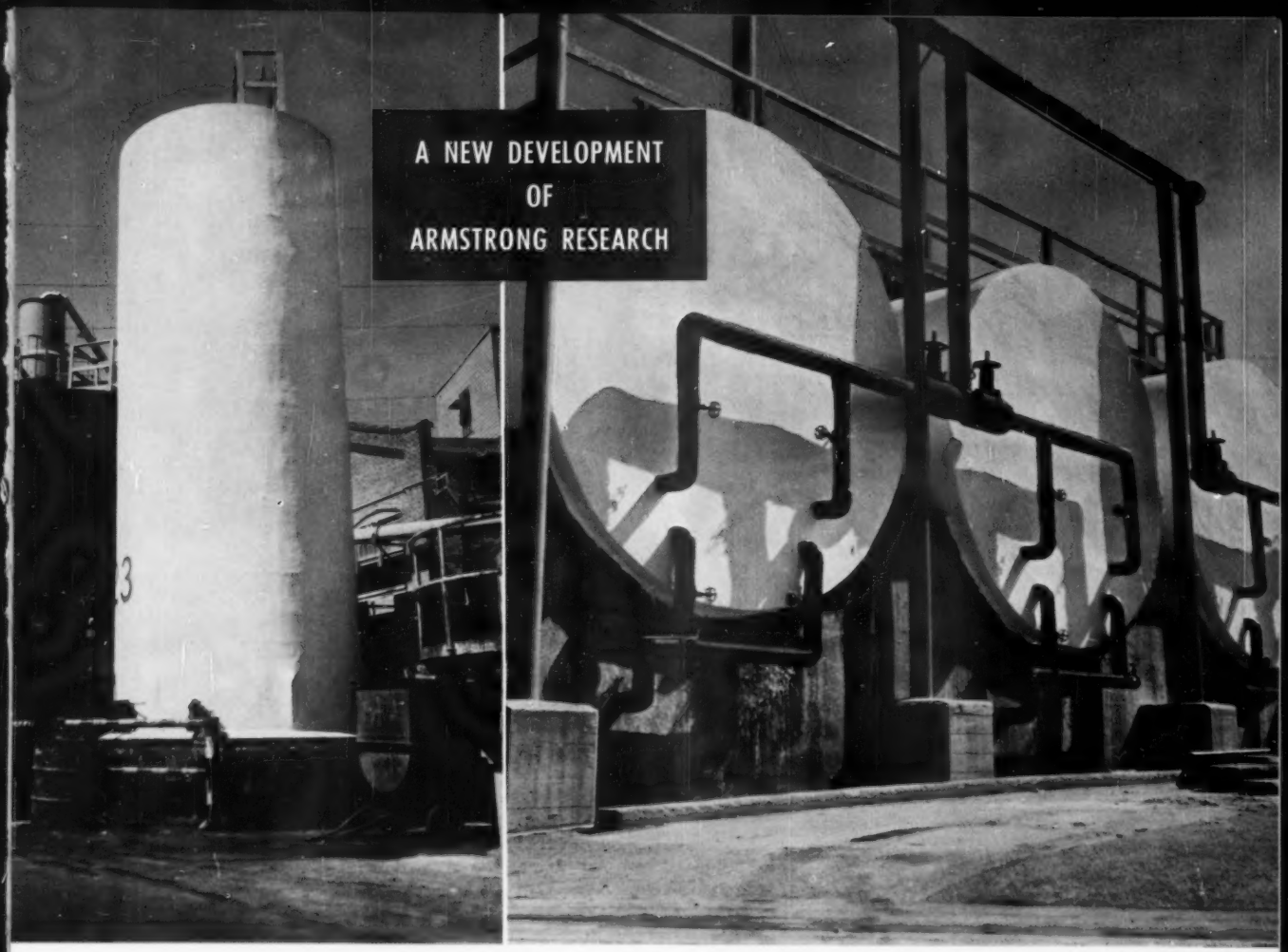
For more data on these items, use post cards p 181. Identify your request with item number.

Hazardous location starters

1261 • Motor starters, *Class I Group D*, are designed for use where hazardous atmospheres and severe corrosive service conditions are encountered. For maximum protection against explosion, all connections, terminals, arcing parts and main line disconnect switches are immersed in oil. Oil-immersion also keeps mechanism lubricated and protected against corrosion.

Starters are of *Valimitor* (volt-ampere-limitor) type and provide over-all short circuit protection for 2200-5000-v motors, irrespective of magnitude of fault or of available capacity. Unit limits maximum possible fault current to 25,000 kva steady state current, and *Type ZHS* magnetic contactors used have ample capacity to clear faults of this magnitude. Actual rating is 50,000 kva interrupting capacity. Because

(*Continued on page* 202)



Insulcolor ... *a rugged plastic finish for insulation—indoors and outdoors*

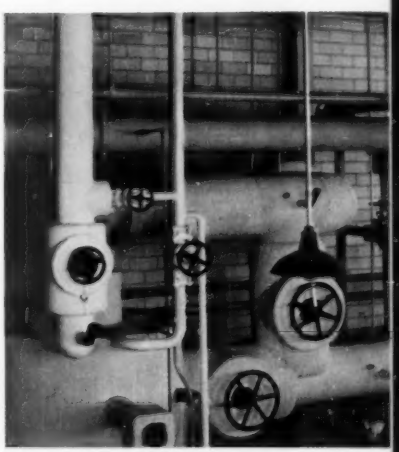
Now you can apply a protective finish to insulated tanks and lines that serves as color identification, too. New Armstrong Insulcolor provides a durable plastic finish in seven colors or white.

Under the most severe outdoor conditions, Insulcolor* will not crack, craze, or peel. The rugged plastic film withstands extremes of temperature and has excellent water-resisting properties. Bumping and abrasion won't damage Insulcolor's smooth, tough surface.

Used indoors, Armstrong Insulcolor is both finish and color key for all insulated steam, refrigerant, and cold water lines. It is also being widely used over cork insulation on equipment, air-conditioning ducts, and in cold rooms. Insulcolor is quickly and easily applied by brush or spray gun. It requires little or no maintenance.

Available through Armstrong's Contract Service, Insulcolor is one of the new products developed by Armstrong Research in the industrial insulation field. For full details on Insulcolor and Armstrong's Insulation Contract Service, call your nearest Armstrong office or write Armstrong Cork Company, 205 Stratton Street, Lancaster, Pennsylvania.

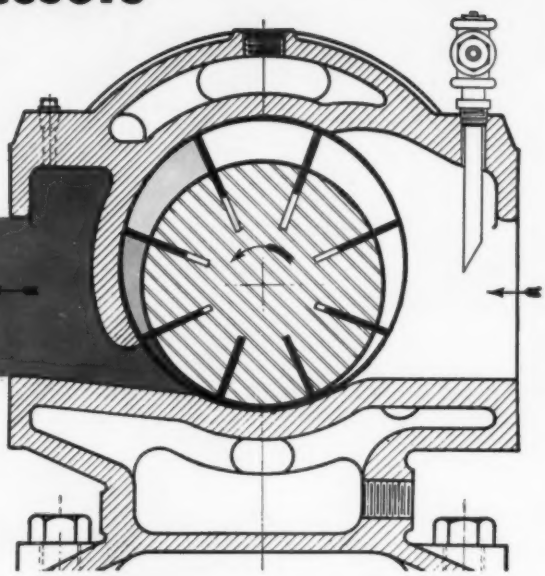
*Trade-mark



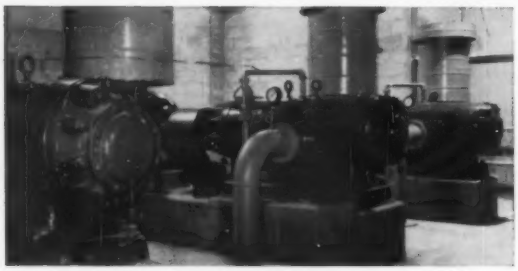
Both insulation finish and code color, Insulcolor eliminates stenciling or the extra expense of painting lines with identifying colors after the finish has been applied.

Armstrong INDUSTRIAL INSULATIONS

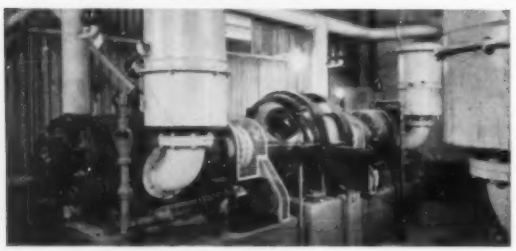
Fuller Rotary Compressors put the SQUEEZE on compression costs



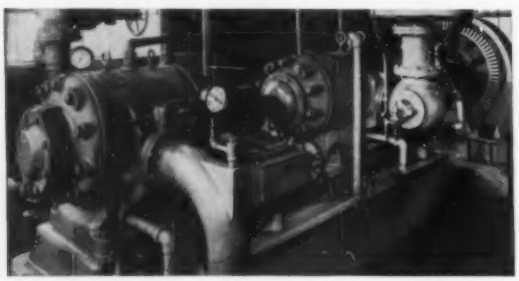
...for pressures up to 125 lb.



Three Fuller Rotary Single-stage Compressors. Capacity each 1400 c.f.m., 19-lb. pressure.



Fuller Rotary Single-stage Duplex Compressor. Capacity 2010 c.f.m., 35-lb. pressure.



Fuller Rotary Two-stage Compressor. Capacity 1665 c.f.m., 100-lb. pressure.

When you consider all the many uses you have for compressed air, you should give careful thought to the best way to get compression with dependability, plus minimum cost and attention —selection of the proper compressor at the required pressures to do the work in the most efficient manner. Fuller builds the compressor that has ***earned*** a reputation for dependability and long life—for pressures up to 125 psig.

Fuller Rotaries have so many inherent advantages that they warrant your closest examination. Free from reciprocating parts, with no valves to leak or seats to grind, no unbalanced forces to set up vibration, they assure low-cost, smooth-flow operation during their long life. And, they give you *original, maintained capacity*.

Check your compressed-air needs . . . a Fuller engineer, specializing in compressed-air engineering, will give you the *right* recommendation to enable you to produce air efficiently, and at the lowest possible cost. Write now.

FULLER COMPANY, Catasauqua, Pa.

Branch Offices

Chicago • San Francisco • Los Angeles • Seattle • Birmingham

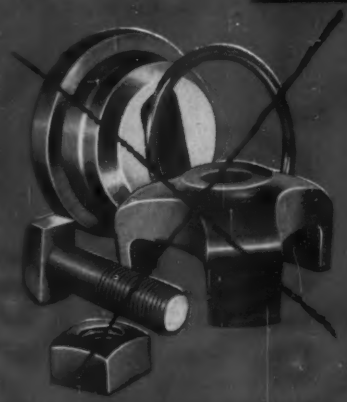
Fuller

C-237
2157

Pioneers of high-efficiency vane-type rotary compressors

CUT boiler stripping and heading time up to 90%

...with KEY safety hand hole caps for boilers with round hand holes



ONE PIECE INSTEAD OF FIVE!

proves leakproof . . . self-tightening . . . 10 times faster than old-fashioned closures.

- **FASTER**—with just one piece instead of 5, Key Safety Hand Hole caps go in quickly . . . save manpower on down-time.
- **TIGHTER**—tapered to fit a tapered hole, Key Caps provide a safe, positive metal-to-metal closure seat. The higher the pressure the tighter the seat.
- **SAVE FUEL**—Dry headers where Key Caps are installed permit simple insulation with asbestos to prevent heat loss.

KEY CAPS PROVE EFFICIENCY...

...in thousands of installations

In this boiler Key Caps were installed in a small section of one header . . . and left for six months to afford a side-by-side comparison with old-style plates. The results were so favorable that Key Caps were ordered for all boilers in the plant!

PROVE KEY CAPS IN *YOUR* PLANT ...ON OUR TRIAL OFFER!

Key engineers will install Key Caps on trial in your plant . . . where you can judge their superiority for yourself. WRITE TODAY—for details on Key Caps and complete information about a trial at your plant.

key company

Since 1916 . . . manufacturers and developers of products for high temperatures and pressures

P.O. BOX 4Y4-C EAST ST. LOUIS, ILLINOIS

DISTRICT OFFICES: NEW YORK • CLEVELAND
CHICAGO • TULSA • HOUSTON • LOS ANGELES

SEVERE SERVICE PACKING

Style 177AI

Here is the tough, dependable packing you've been looking for. Style 177AI is built to take punishment . . . to easily withstand pressures as high as 2000 psi . . . remain resilient at temperatures to 1200°F. It's a packing that will give you the kind of service you've always wanted in high temperature valves, soot blowers, gauge glass fittings and similar applications.

Style 177AI is dry graphite lubricated to reduce friction to a minimum. Each strand of the closely braided asbestos yarn top jacket is reinforced with Inconel wire. Core consists of long fibre asbestos and flake graphite.

Available in Spools or in Die-Formed Rings. Rings available with either square cross section or with special bevels for concave-convex nest sets.

Get full information on Style 177AI Packing now. Request catalog describing the full line of "John Crane" Packings.

CRANE PACKING CO., 1830 CUYLER AVENUE, CHICAGO 13, ILLINOIS.

In Canada: Crane Packing Co., Ltd., 617 Parkdale Ave., N., Hamilton, Ont.

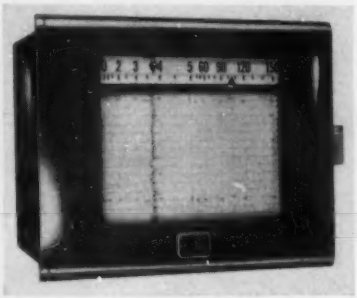
JOHN CRANE CRANE PACKING COMPANY 38 YEARS INDUSTRIAL PROGRESS

More EQUIPMENT NEWS

Begins on page 172

the *Valimitor* starters are capable of limiting infinite available kva to a low finite value, they are readily adaptable to a wide range of motor sizes without change.

Electric Controller & Mfg Co, 2767 E 79th St, Cleveland 4, Ohio



Voltmeter-ammeter recorder

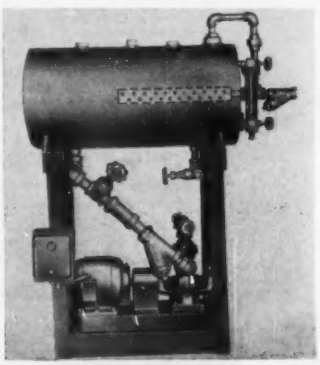
1262 • Wide-strip electronic recorder measures and records current and voltage simultaneously on one chart. Primary measuring elements are a thermal-voltage converter and a thermal-current converter, ac/dc transducers. Instrument has accuracy within 1% and sensitivity of 1/20th of 1%, according to manufacturer.

Chart is divided into two zones, half used for recording amperes, half for volts. Calibration of each follows law of squares, giving expanded graduation in normally used section of the range. Chart speeds from ¾ in. per hr to 4 in. per second are available through easily changed gears.

Because of high torque output, auxiliary functions, such as high-alarm contacts or retransmitting slidewires, can be added without affecting accuracy or sensitivity.

The Bristol Co, Waterbury 20, Conn.

For more data on these items, use post cards p 181. Identify your request with item number.



Boiler feed system

1232 • Boiler feed system incorporates a pre-heater that operates on steam from the boiler. Unit is claimed to automatically maintain boiler feedwater between 190 and 200 F. Tank sizes ranging from 30 to 540 gallons supply from 280 to 2800 gallons of pre-heated water every hour. Manufacturer states that pre-heating boiler water increases boiler life by eliminating stresses caused by low temperature feedwater en-

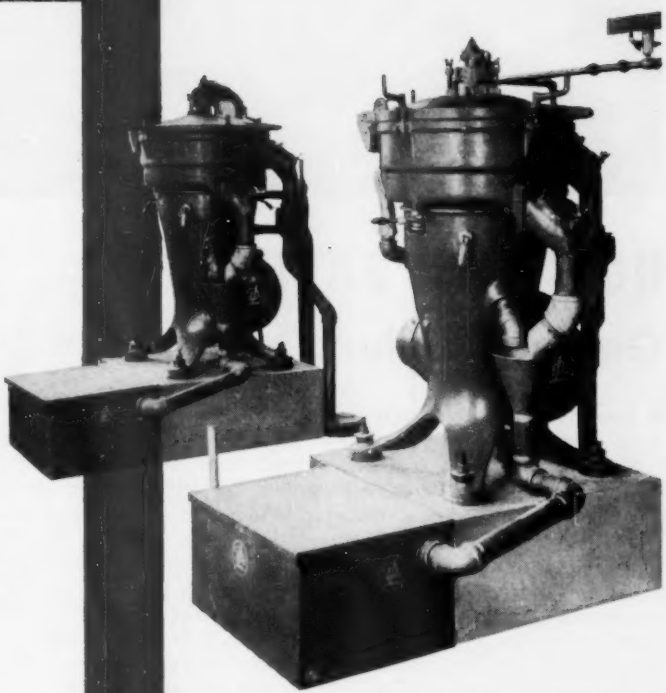
WHY MORE DIESELS ARE RUN ON RESIDUALS PURIFIED BY DE LAVAL

The main reason is cost-cutting . . . considerable savings in your plant. Because heavy fuels are much cheaper than light distillates . . . and most diesel engines can be easily converted to burn these residuals, give you a sizeable economy.

De Laval Purifiers take all the problems out of purification — they prepare the fuel properly . . . remove the maximum of incombustible solids and ash at *constant operating speed and efficiency*.

If the oil can be pumped, De Laval can purify it! Right now, De Laval Purifiers are handling oils having viscosities between 5000 and 6000 SSU at 100° F — in plants from coast-to-coast. Oils of greater specific gravity than water are also being purified.

Write for all the details . . . today. Your plant profits can be increased with De Laval Heavy Fuel Purifiers! . . .



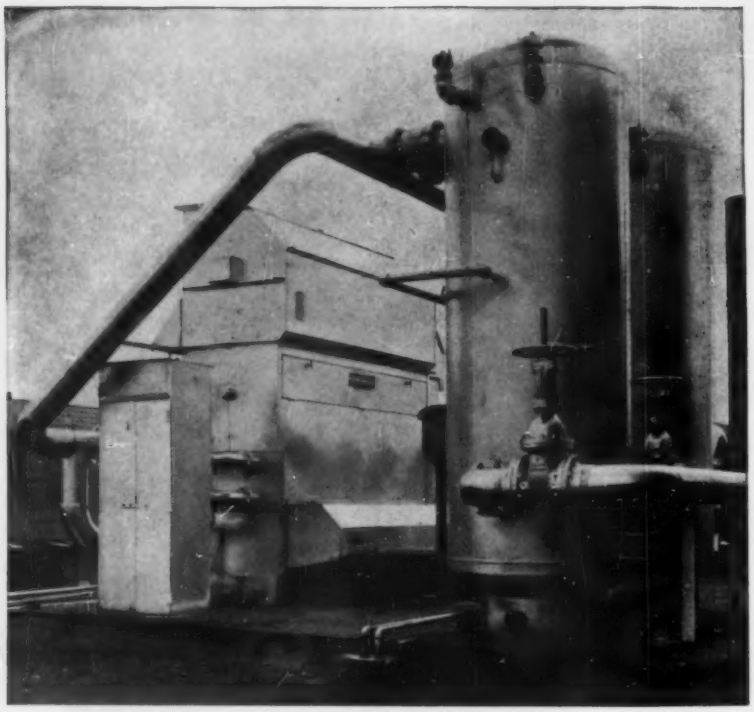
TYPICAL PURIFYING RESULTS

	Unpurified Oil	Purified Oil
Specific gravity at 60°/60° F.	0.968	0.968
Viscosity SSU at 100° F.	5000	5000
Viscosity SSF at 122° F.	225	224
BS&W per cent by volume	0.60	0.20
Water by distillation, per cent by wt.	0.04	Trace
Ash at 550° C., per cent by wt.	0.045	0.021
Sediment by hot extraction	0.063	0.008

DE LAVAL

heavy oil purifiers

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • **DE LAVAL PACIFIC CO.** 61 Beale St., San Francisco 5



HOW YOU SAVE,

Getting Drier Compressed Air

● Direct saving in the cost of cooling water saves the price of the Niagara Aero After Cooler (for compressed air or gas) in less than two years.

Extra, for no cost, the drier air gives you a better operation and lower costs in the use of all air-operated tools and machines, paint spraying, sand blasting or moisture-free air cleaning. Water saving also means less expense for piping, pumping, water treatment and water disposal, or you get the use of water elsewhere in your plant where it may be badly needed.

Niagara Aero After Cooler assures all these benefits because it cools compressed air or gas below the temperature of the surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air thru a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter by the Niagara Balanced Wet Bulb Control.

Write for complete information; ask for Bulletin No. 98

NIAGARA BLOWER COMPANY

Dept. P, 405 Lexington Ave. New York 17, N. Y.

Niagara District Engineers in Principal Cities of U. S. and Canada

INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

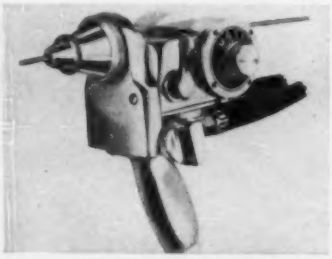
HUMIDIFYING • AIR ENGINEERING EQUIPMENT

More EQUIPMENT NEWS

Begins on page 172

tering the heated boiler shell. Pre-heating makeup water also makes it easier for boiler to maintain pressure during peak load periods and reduces boiler scale.

Cyclotherm Division,
U.S. Radiator Corp, Oswego, N. Y.

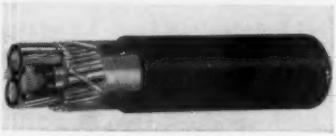


Metallizing gun

1226 • *Turbo-Jet* metallizing gun is claimed to accommodate all spraying operations, making it ideal for production, maintenance and anti-corrosion spraying applications. May be used in a tool post or hand operated. Unit uses wire from 20 gauge to 3/16 in. dia from highest melting point molybdenum to lowest melting point wires. Dual feed rolls, individually driven, eliminate wire slippage through gun and provide more positive feed, according to manufacturer. Unit operates on acetylene, propane, or natural gas at 15 psi.

Metallizing Company of America,
3520 W Carroll Ave, Chicago 24, Ill.

For more data on these items, use post cards p 181. Identify your request with item number.



5000-volt power cable

1236 • Non-metallic sheathed cable is designed especially for 5000-v power feeder service. Smaller diameter and lighter weight are features obtained by using polyethlene insulating compound and a polyvinyl-chloride sheath, according to manufacturer. Cable has three conductors, each individually shielded throughout its entire length with a metallic shielding. Ground wires are placed in interstices in contact with shielding on individual conductors. Fillers used round out the core assembly. Sizes range from 6 AWG to 250 MCM.

Rome Cable Corp, Rome, N. Y.

Aluminum locknut

1263 • All-metal self-locking locknut of high-tensile aluminum meets or exceeds minimum tensile requirements for steel nuts, according to manufacturer. Nut is said to have torque and strength characteristics of standard all-steel nut, but weighs 65% less. Spring tension of resilient segments of locking section lock nut securely at desired position whether seated or not. It can be reused without loss in locking efficiency.

Standard Pressed Steel Co,
Jenkintown, Pennsylvania

ALL FORGED STEEL

Edward UNIVALVES

Lower Pressure Drop 25-50% with Straight-Thru Flow

As shown photographically here, the streamlined internal contours and the inclined stem construction of the Edward Univalve give straight through flow — which careful laboratory tests have shown to result in pressure drop 25 to 50% lower for Univalves than other globe valve types. Turbulence, too, is greatly lowered by these streamlined contours. And lowering turbulence lengthens valve life by eliminating vibration, the principal cause of wear in small globe valves.

But lower-pressure drop and less turbulence are not the only reasons the Univalve has become an industry standard for tough high pressure, high temperature services. Here are just a few of the benefits which add up to longer life and lower maintenance for this outstanding all forged Steel Valve.

LONGER PACKING LIFE **through a positive backseat and deep cooling chamber which protects packing in service. Isolation of packing prevents blow-out when repacking under pressure.**

PERFECT ALIGNMENT, EASY DISASSEMBLY **when necessary, through foolproof patented body-bonnet connection.**

EXTRA WEARING SEATING SURFACES— **seat formed by application of continuous ring of Stellite to valve body; Stellite hard-facing applied to alloy steel disk.**

EASY PACKING ADJUSTMENT **with through bolted, accurately guided gland.**

EFFORTLESS SEATING **with Impactor handwheel in sizes 1¼ in. and larger.**

DESIGNED FOR HIGH-PRESSURE, HIGH-TEMPERATURE APPLICATIONS
Two different classes rated for 1500 lb sp at 1023F or 2500 lb sp at 1033F.

AVAILABLE IN A WIDE RANGE OF SIZES
Furnished in 1500 lb or 2500 lb pressure classes in sizes from ½ in. to 2 in.

CHECK VALVES, TOO
Check type Univalves, of spring loaded piston design, have the same basic construction as globe Univalves. Use them together for all welded construction for small pipe lines, eliminating all bonnet joint leakage problems.

IDEAL FOR BLOW-OFF SERVICES
Univalves meet all ASME code requirements for blow-off service and are adaptable for high pressure installations to 3120 psi boiler pressure.

Get the full story on Univalves, ideal all-purpose steel valves—write for Catalog 12G1.

Rod through Univalve demonstrates straight thru flow of this valve.

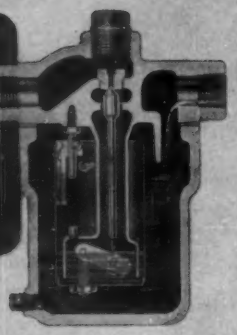
Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY
1220 W. 144th St. • East Chicago, Indiana

Another Product

Reliability

DESIGNS THAT REPRESENT 50 YEARS TRAP BUILDING EXPERIENCE



"airxpel"

STEAM TRAPS

Remove Both Air and Condensate

"CUB" TYPE
½" to 1½"
to 250 PSIG

"MASTER" TYPE
½" to 2"
to 300 PSIG

"Y" STRAINERS
2" to 8" (flanged)
½" to 3" (threaded)

FORGED STEEL
½" to 1¼"
to 600 PSIG

This equipment offers design advantages that represent long experience in building steam saving devices for industry.

Orifices of Wright-Austin traps can be interchanged without disassembling the trap. Connections are the straight-through type. Both of these features contribute to speed and ease of installation.

Wright-Austin traps are available for lines ½" to 3", for pressures up to 600 P.S.I.G. and with capacities up to 65,025 pounds of water per hour.

For complete information on traps and other accessories that you can stock to advantage and depend on for efficiency that means low cost, write, today, for:

Trap Catalog #600
Separator Catalog #500
Boiler Trim Catalog #700

WA Standard since STEAM USERS SINCE '94

WRIGHT-AUSTIN
COMPANY
3245 WIGHT STREET • DETROIT 7, MICH.

MARMADUKE

Continued from page 160

good engine, but the camshaft was in sad shape, causing the engine to lose power. That was bad in heavy seas when all her power was needed to keep the ship off the many reefs and shoals around the islands.

"Her old, native Chief had done a hitch in the US Navy back in 1904. He was a good all-round ship's engineer and I liked him. He told me he'd ordered a new camshaft about six months before and if it wasn't in Manila that trip he'd raise plenty of hell.

"We made Manila in two weeks, but the camshaft didn't show up until an hour before sailing time. After bringing it aboard we lashed it down along the starboard companionway. The Chief's plan was to replace the old camshaft in the first port where we had enough time.

"Sailing out of the bay past Corregidor Island that evening we ran into a blow that soon roared into a typhoon. Approaching Calabite Point, the engine began to labor heavily and our small ship took 25-degree port and starboard lists on every roll. That sick engine almost caused the strong winds and heavy seas to drive us against the rocky coast. It was only the topnotch seamanship of the skipper—and luck—that got us safely away.

"Reaching San Jose, we docked at the Mangarin Wharf. The Chief didn't lose any time—that last blow was too much for him. He went topside to the Captain to see if we'd have enough time alongside the wharf to replace the old camshaft. The skipper said he was mightly anxious to have the engine deliver her full-rated power. But he pointed out we had only six hours in port and explained we'd have to get back to the open sea before the tide got out from under us.

"The Chief came below and checked with me, then promised the skipper we could change the old camshaft in that time. After some argument the old man gave him the green light. But only after the Chief had assured him a dozen times that six hours was plenty of time.

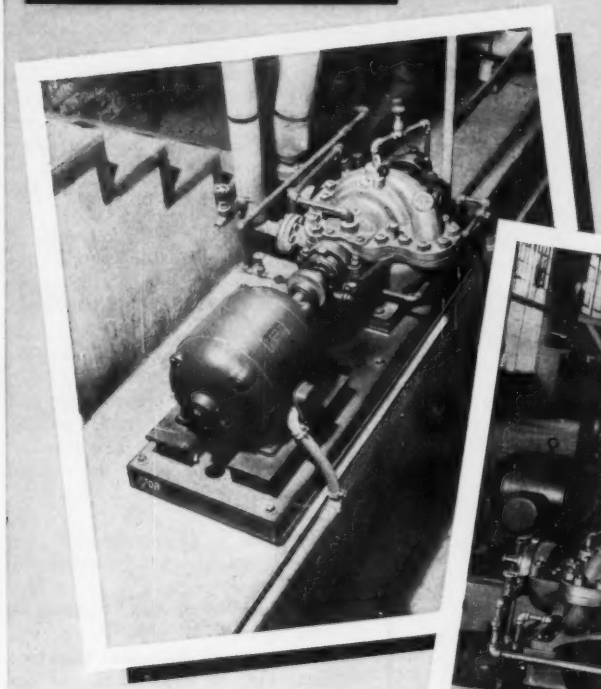
"I got the three oilers and some deck hands to carry the camshaft below. Then I had them clean the gear on the shaft's end, which was one solid forging with the camshaft. To be on the safe side, I started to compare the marking on the new gear with the old camshaft gear marking.

"But the Chief was on edge and told me not to waste time with that because we'd have to hurry. Said he knew the new camshaft was OK because he had made out the requisition himself.

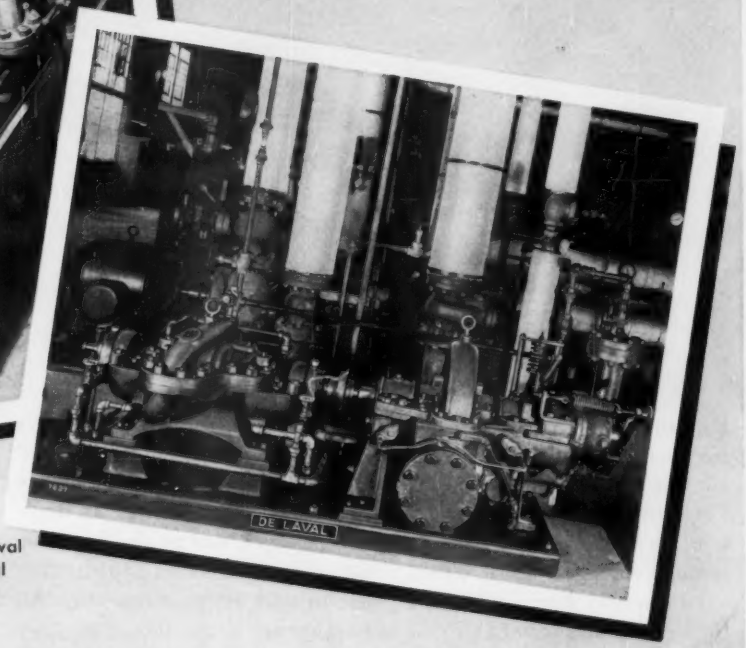
"We worked at top speed and before long the old shaft was on the floor

DE LAVAL
TWO-STAGE HORIZONTAL PUMPS

for dependable boiler feed service in institutions . . . industrial plants



Institutions can't afford shutdowns. In this hospital installation a motor-driven 21S boiler feed pump provides year-in, year-out dependability. It delivers 70 gpm of 240° water at 420 ft. head.



Industrial plants, too, choose reliable De Laval pumps for boiler feed service. This De Laval unit, driven by a De Laval turbine, delivers 160 gpm of 215° water at 520 ft. head.

There are good reasons why De Laval 21S-2KS two-stage horizontal split case pumps give long, economical boiler feed service. They are designed with • back-to-back impellers for balanced hydraulic thrust • easily replaceable threaded impeller wearing rings • long life labyrinth case rings • ring oiled ball bearings — plus ten other important design features.

These De Laval pumps are available in sizes from 2" to 8" discharge, for capacities from 75 to 3,000 gpm and heads to 750 ft.

Write for Bulletin 1501 giving complete data.

DE LAVAL *Boiler Feed Pumps*

DE LAVAL STEAM TURBINE COMPANY

815 Nottingham Way, Trenton 2, New Jersey

D1-272

City of Winnipeg plant reports LATTICE BRAID* lasts longer, causes less sleeve wear than ordinary pump packings

*Registered Trademark. *Only* Garlock makes LATTICE BRAID rod and shaft packings.

By using LATTICE BRAID asbestos packing on their centrifugal boiler feed pumps, the City of Winnipeg Hydro's Steam Turbine Plant (Canada) is able to go a *complete season* without replacing the packing. The best service from previous packings was 3 to 6 months. In addition, LATTICE BRAID causes less wear on sleeves, and retains its shape throughout its service life, thus resulting in fewer gland adjustments.

Put Garlock LATTICE BRAID Packing to work for your company. All the braided strands of this unique packing are lattice linked together into one structural unit. The strands hold together even when the packing is worn far beyond the limits of wear of ordinary braided packings.

LATTICE BRAID is made from flax, cotton, asbestos, wire-inserted asbestos, Teflon, and asbestos with Teflon impregnation—for various types of services.

Get all the facts about LATTICE BRAID *Packings. Contact your Garlock representative or write for new folder AD-131.*

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

Sales Offices and Warehouses: Baltimore • Birmingham • Boston • Buffalo • Chicago • Cincinnati • Cleveland Denver • Detroit • Houston • Los Angeles • New Orleans • New York City • Palmyra (N. Y.) • Philadelphia Pittsburgh • Portland (Oregon) • Salt Lake City • San Francisco • St. Louis • Seattle • Spokane • Tulsa.

In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

GARLOCK LATTICE BRAID PACKING

MARMADUKE

Continued from page 206

plates and the new camshaft in place. Just as we tightened the last bearing nut, the engine-room telegraph rang violently back and forth, stopping on STANDBY. The skipper was getting hot under the collar because the tide was running out. We rushed around to ready the engine for starting.

"The Chief ran topside to the bridge to talk to the old man. But the telegraph clanged again before we had the auxiliaries started. This time the pointer stopped on HALF ASTERN. The engine room was a madhouse as everyone tried to help so we could answer the Captain's signal. I finally grabbed the control wheel and turned it to ASTERN, then turned the speed regulator to HALF.

"I could feel the extra power from that new camshaft as the engine revvied up to half speed—but for some reason I felt all wasn't shipshape. Then BANG—CRASH—we were jolted from stem to stern as the ship plowed into something.

"I flipped the controls to STOP and closed the fuel throttle without waiting for the telegraph to ring. Just then the Chief came leaping down the engine-room ladderway, two steps at a time, yelling his lungs out.

"'Why you go ahead when ol' man give signal go astern?' he screamed, blowing a gasket.

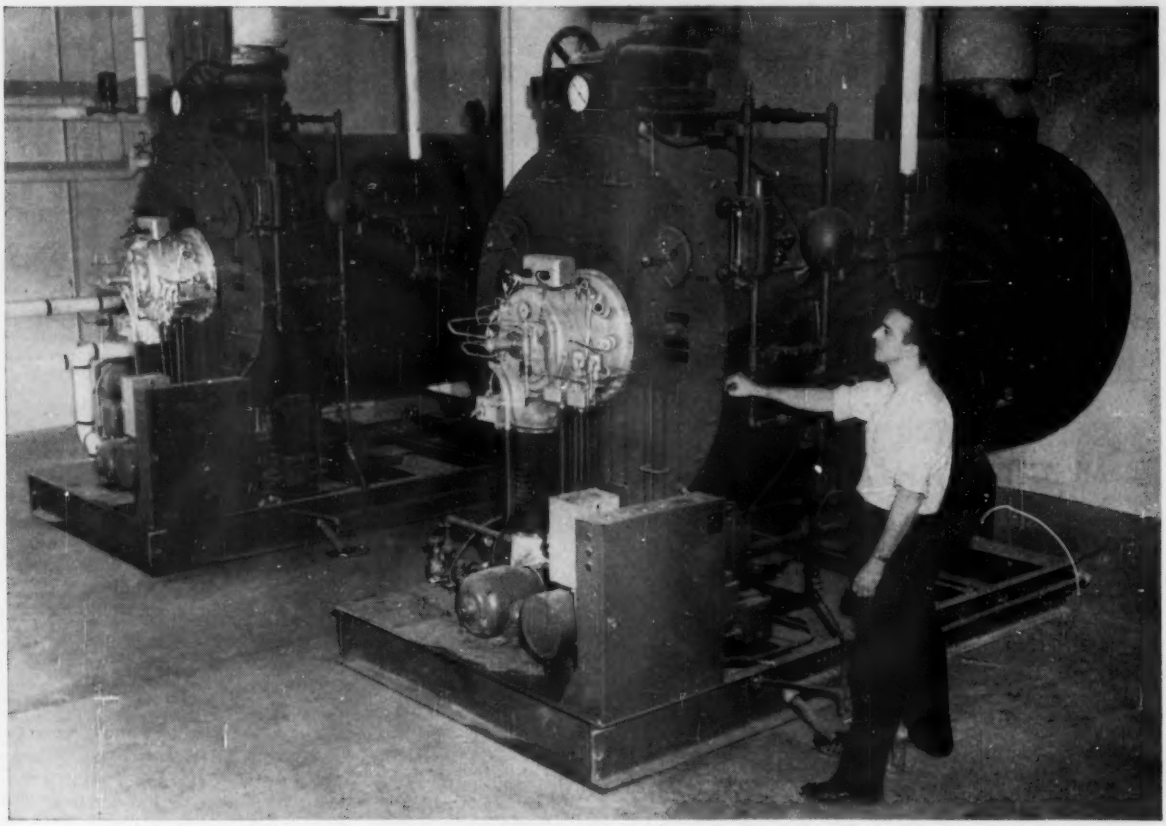
"'Somebody's fogbound,' I answered, pointing to the bell book. The Second Assistant, a good Joe named Leonardo Villarta, assured him I had put the engine astern. He had been answering the telegraph and marking the bells and time in the bell book on log desk's.

"That calmed down the Chief, so I told him to keep his eyes on the engine's drive shaft at the after end while I started the engine ASTERN. He did and found she started turning AHEAD. By now the old man on the bridge was yelling into the speaking tube. The Chief yelled back to him the engine was haywire, so he might as well tie up again. What the old man said isn't for publication.

"Back to work we went. Comparing the camshaft markings, I found that we got a left-hand instead of a right-hand camshaft. That called for action. I remarked the new camshaft's gear to conform with the old one, then meshed it so the engine would fire properly. But by the time we had finished, our ship was firmly stuck in the mud. That delayed us about 20 hours.

"The Captain got a few more gray hairs during that time. To add to his troubles, the wharfinger demanded heavy damages for smacking his wooden wharf. Besides being badly shaken, it

IN PUBLIC UTILITIES...



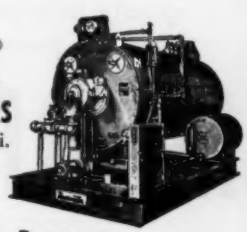
Powermasters® Save in Many Ways

For example: These two 125 HP *Powermaster* Packaged Automatic Boilers were recently installed to heat the garage and warehouse areas in Metropolitan Edison Company's new headquarters building, Reading, Pa. This electric utility also has a *Powermaster* unit for auxiliary service in one of its power stations.

Like all *Powermaster* boilers, these units excel in operating efficiency... the real pay-off in boilers. Other *Powermaster* advantages include: Cost-saving installation, space-saving compactness, fast steaming, high fuel economy at all loads, hospital-clean operation, dependable performance, maintenance-saving accessibility, fully automatic operating and safety controls, and smokeless combustion.

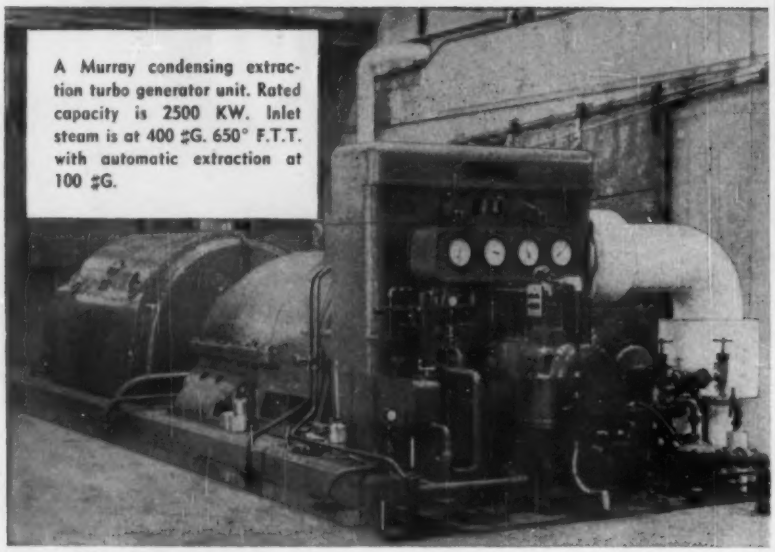
Compare now... and see why *Powermaster* is today's best buy in boilers for steam and hot water in industrial plants, all types of buildings, institutions, housing projects, schools and other requirements. Get the profitable facts on *Powermaster*. Write for latest descriptive bulletin.

O·S *Powermaster*®
PACKAGED AUTOMATIC BOILERS
In sizes to 500 HP; pressures to 250 psi.



ORR & SEMBOWER, INC. • Established 1885 • **Morgantown Road, Reading, Penna.**

Murray Turbines



A Murray condensing extraction turbo generator unit. Rated capacity is 2500 KW. Inlet steam is at 400 #G. 650° F.T.T. with automatic extraction at 100 #G.

Murray Turbo Generator units can be furnished to meet your special requirements in sizes up to 3000 KW. Condensing and non-condensing types with or without extraction and/or mixed pressure features can be furnished. Whether you require a small inexpensive standby unit or a highly efficient, and reliable source of power, Murray has a design to fit your needs.

Consult your local Murray representative who will gladly help you select the unit most economically suited to your conditions.

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century

MARMADUKE

Continued from page 208

had some broken sections. And a big stack of bagged copra and boxes of merchandise were knocked off the wharf into the drink. Some natives fishing on the wharf's opposite side were shaken into the water and one drowned.

"Next morning while still stuck fast in the mud, the Chief called me to his cabin. He handed me the engine manufacturer's duplicate order for the camshaft and asked if I found anything unusual. I noticed the word camshaft, but it didn't make sense because the initials RH or LH were missing.

"The Chief then handed me the copy of the requisition he had sent to the line's office in Manila. Sure enough, it was clearly typed RH CAMSHAFT.

"'See, not my fault, not my fault,' gloated the Chief, handing me a bottle.

"A week later in Manila the Chief and I called on the purchasing agent. After a lot of double talk, he sent a cablegram to the states. The manufacturer answered that they were out of right-hand camshafts at the time and because the order was marked URGENT, they sent what they had. They added they thought we were bright enough to check the gear markings. And to make it worse, the purchasing agent agreed with them.

"The Chief Engineer and I were too disgusted to answer. Some paper jacks just don't seem to know what a guy running a plant is up against. We really burned up the old walled city in Manila that evening before shoving off.

"A few weeks later we finally reached Zamboanga where I got the next Dollar ship back to the states.

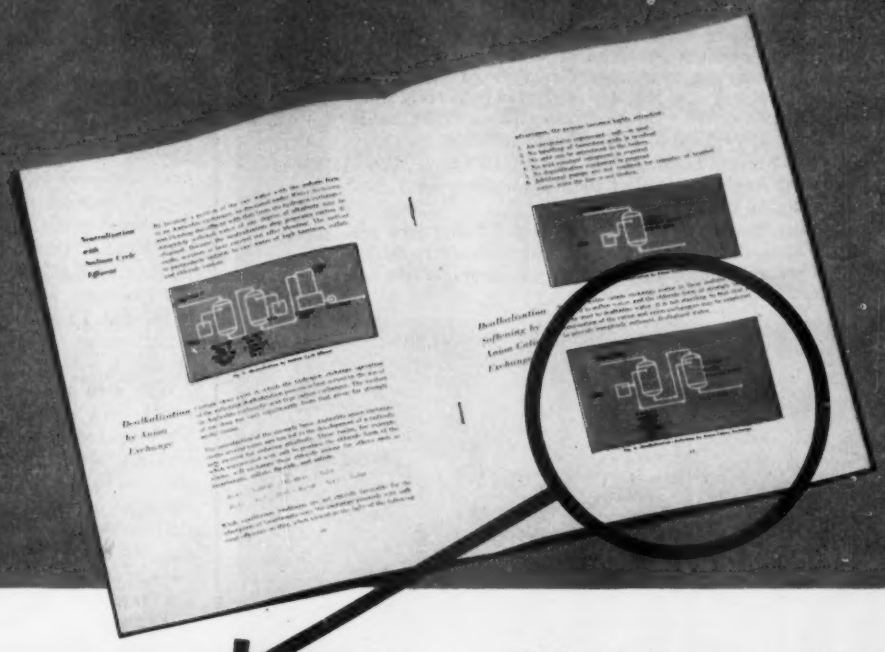
"But that experience taught me one thing," roared Marmy as he turned back to his desk. "It's bad enough to receive the wrong replacement part near the supplier, but when you're on a small jungle island, on the other side of the globe—the wrong part can mean hours of useless sweat in a red-hot engine room, loss of life and property damage.

"And another thing," he bellowed, as I started for the door. "Tell the manufacturers that before they fill a replacement-part order, especially to some out-of-the-way place, the least they can do is to have some guy with a little savvy check the order, look up the prints of the original equipment that parts are for, check the parts on the shipping platform, then check the final letter of instructions being sent with the shipment.

"The 30 minutes spent in making these checks is peanuts compared to the headache they can save the engineer waiting for the order."

EDITOR'S NOTE: *Marmy is right. How about showing this story to your shipping department.*—SME

AMBERLITE ION EXCHANGE RESIN REDUCES ALKALINITY WITHOUT ACIDS OR DEGASIFIERS



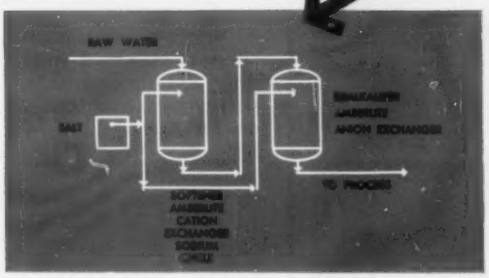


Fig. 6—Dealkalization-Softening by Anion-Cation Exchange

A strongly basic AMBERLITE anion exchange resin permits control of alkalinity of water supplies for boilers and cooling systems conveniently and at low cost. Only common salt is required as regenerant for the resin. No acids are used, hence expensive acid-resistant equipment and associated handling problems are eliminated. Because no degasifier is required, line pressure is not broken, and pumping costs are reduced.

New Book Gives Valuable Information on Water Treatment Problems

Rohm & Haas Company's new book, *If You Use Water*, discusses this up-to-date technique —and many other ion exchange methods of water treatment as well. Softening, combination softening-dealkalization, silica removal, deionization, are just some of the topics considered. Your request for this book will bring you a copy promptly, will show you why in ion exchange the resin that's *right* is AMBERLITE.

Send for your free copy of this book today

CHEMICALS FOR INDUSTRY

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AMBERLITE *is a trademark, Reg. U.S. Pat. Off. and in principal foreign countries.*

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Please send me a copy of "If You Use Water..."

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City_____ Zone____ State_____

DUAL CONTROL means ECONOMY

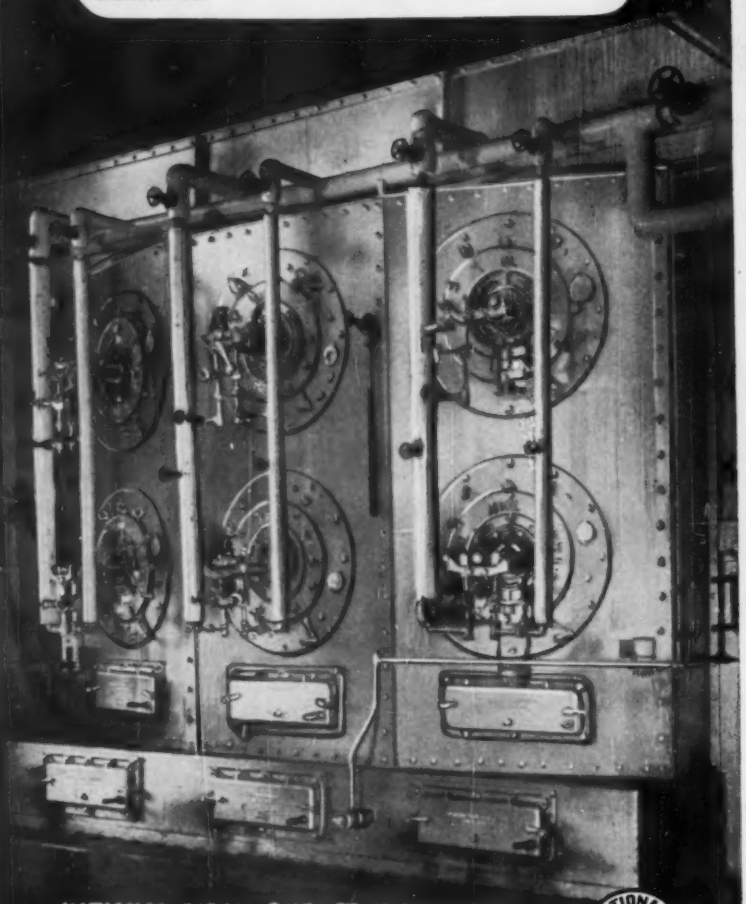
with NATIONAL AIROIL Universal Registers

AND TYPE "S-A-L" OIL BURNERS

. . . and economy means that you get better performance with NATIONAL AIROIL Universal Registers because they have a dual feature for controlling air volume independent of turbulence. Air vanes can be instantly reversed to change direction of turbulence while air volume is separately regulated by a refractory faced disk control. Both adjustments can be made while the Type "S-A-L" Oil Burner is firing.

Another "dual advantage" of NATIONAL AIROIL Universal Registers is that they are equipped for dual fuel firing of gas and oil.

Universal Registers with Type "S-A-L" Burners are available in three (3) sizes . . . capacities up to 60,000 lbs. of steam produced per burner per hour. Write for Bulletin 51.



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BRITISH AMERICAN OIL COMPANY

NATIONAL AIROIL BURNER CO., INC.

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INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

SELECTING PERSONNEL

Continued from page 127

took trips to other power plants, to a coal-mine plant and to plants in our own system. We tried to schedule one trip a week.

After completing our scheduled program, instruction book of each piece of equipment in plant was group-read and discussed. Book was passed around so each man could again take part.

Bull sessions were held to discuss plant subjects. Important subjects like lighting off boiler or starting turbine were discussed several times. The idea was to have each man proficient enough to prevent costly error on start-up, as that is when accidents usually happen.

Next, we had each employe jot down five questions he couldn't answer, five he could. These were read to group. Questions were answered and discussed at length.

Now men were ready for tests that would help us select shift engineers. We prepared five tests of 20 questions each, covering all plant operations. Men also had to sketch diagram of sub and makeup system.

Tests were graded and each employe was told his average score. Then highest scorers were given the best jobs. The large number of questions answered correctly by inexperienced men surprised us. They had learned all this from our training.

Crews were selected next. Although shift engineer's shift would rotate opposite other two shifts, we picked a boiler-turbine man and an auxiliary man for each group that would click and work together. This opposite rotation is desired so shift engineer can rate and grade each of his men. Each unit of three was then told to study prints, books and entire plant so each shift engineer would have well-instructed men.

Suppliers of various equipment were asked to instruct us on their equipments and maintenance. Most suppliers either couldn't make it or wanted to give instructions when their service man arrived to put equipment into operation.

Projector of 16-mm with sound was purchased. We found several good films. Particularly good boiler films were obtained from Riley and B&W for the asking by paying only postage. Only turbine film we learned about was not available.

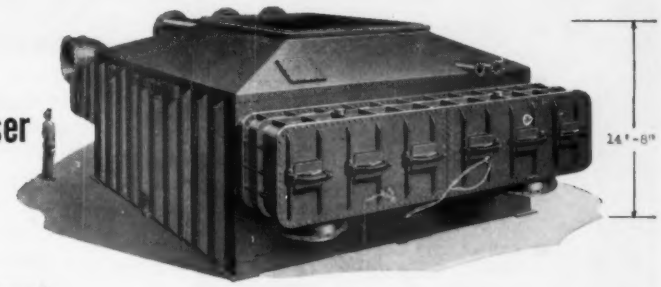
Book of operating instructions is important, so we gave each man the job of helping to prepare one. First drafts were checked by group, then typed, dittoed and placed in folders. Copy was given each employe.

Three men worked up the log sheets. Here we wanted to record only impor-

More Power TO FLORIDA'S VACATIONLAND

FLORIDA POWER & LIGHT CO. CUTLER PLANT, Design and construction supervision by EBASCO SERVICES, INC.

and 135,000 kw Unit #6 will be served by an I-R 65,000 sq. ft. surface condenser *only 14' 8" high!*



To keep pace with the ever-growing load demands of Miami and its surrounding resort area, Florida Power and Light Company is engaged in a construction program that will bring its total generating capability to over one-million kilowatts by 1956.

The Cutler Plant's capacity will be increased to 375,000 kw when Unit #6, rated at 135,000 kw, goes on the line in 1955.

As illustrated above, the condenser for the sixth unit at Cutler shows what can be done to reduce basement height and still retain the advantages of conventional condenser arrangement. This 65,000 sq. ft. unit only 14' 8" high embodies the same basic design features that have earned Ingersoll-Rand surface condensers their enviable reputation for performance.

Flexibility in design, as exemplified by this installation, is our forte. Your station layout problems can be met in a similarly efficient, economical manner if you'll call in Ingersoll-Rand surface condenser specialists.

4-71

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Demineralization and Silica Removal

CATEXER® ANEXER® PLANTS

provide the low silica, low solids boiler feed makeup water so essential to the operation of high pressure boiler and turbine operation in the plants listed below.

Good Equipment is known by the Company it keeps....

- PUBLIC SERVICE CO. OF NORTHERN ILL.
  Waukegan, Ill. (3 bed – 250 g.p.m.)
- WISCONSIN POWER AND LIGHT CO.
  Sheboygan, Wis. (2 bed – 60 g.p.m.)
- WESTERN ELECTRIC CO.
  Hawthorne Sta., Chicago, Ill. (2 bed – 200 g.p.m.)
- INTERSTATE POWER CO.
  Dubuque, Iowa (2 bed – 30 g.p.m.)
- INTERNATIONAL PAPER CO.
  Natchez, Miss. (2 bed – 900 g.p.m.)
- INTERNATIONAL PAPER CO.
  Panama City, Fla. (2 bed – 1200 g.p.m.)
- CALIFORNIA ELECTRIC CO.
  High Grove, Calif. (2 bed – 40 g.p.m.)
- NATIONAL PETROCHEMICALS CORP.
  Ficklin, Ill. (2 bed – 400 g.p.m.)
- WISCONSIN POWER AND LIGHT CO.
  North Beloit, Wis. (2 bed & mixed bed – 40 g.p.m.)

for useful information
on sodium, hydrogen or anion exchangers...
write for INFILCO Bulletin 1960-K.

INFILCO INC. | *Tucson, Arizona*

Plants in Chicago and Joliet, Illinois

Field offices in 33 principal cities in the U. S., Canada and Mexico

SELECTING PERSONNEL

Continued from page 212

tant readings. That led to discussions before we had ones we wanted.

Group of men was assigned task of working up spare-parts list, another group prepared lubrication charts. We also purchased oxygen and gas at that time and gave instructions on welding and cutting.

As plant neared completion, each shift engineer and his group was given job of checking a part of plant piping system.

Plant electrician checked the sub and plant wiring. Coal men checked the coal conveyors. Discrepancies were found, such as leaving out valves where it would be impossible to operate without them.

Like everyone else, we tried to do some work at the plant, but we found that construction unions would not let us do a thing. We even had trouble when hauling material to plant. Quite a few times the union insisted that truck return to edge of plant property, where they would accept the material. To keep peace and harmony on the job, we had to do a lot of things.

Now our plant has been operating almost one year and we know that time spent in selecting and training employes has paid off. We've had only two cases of operating trouble from our personnel to date—both minor.

EDITOR'S NOTE: *If you are interested in knowing more about tests, let us know and we'll prepare an article giving you specific information on various test sets on the market, both for hiring and for promotion to key jobs in your plant. Tests are widely used today.*

WITH OUR READERS

Continued from page 5

modernizing the Waldorf's air conditioning, received a similar citation.

In Detroit, the consulting firm of Boddy, Benjamin and Woodhouse were hosts at a dinner where Lou presented citations to their clients, Hudson Motor Car Division of American Motors Corp, and Motor Products Corp. Just a week later, Associate Editor Jim O'Connor journeyed to St. Louis to give a citation to F W Marlow, mechanical superintendent of Krey Packing Co. The occasion was a dinner honoring Marlow, who is retiring.

An interesting personal touch was added to the ceremonies at the Dept of Sanitary Engineering, Washington, D.C., where fellowworkers took the occasion to surprise M H Kinsinger, chief mechanical superintendent. On arrival at the District Building, he found his wife, decked out in a gift orchid, and all his associates, who gave him a pen and pencil set. As an extra souvenir of the occaison, one of the boys made a tape recording of the proceedings.

(*Continued on page 216*)

This Mead-Morrison Unloader is installed at the Indiana & Michigan Electric Company's new Tanners Creek Plant at Lawrenceburg, Indiana. It is regularly operating in free digging at a maximum capacity of over 700 tons of coal per hour from barge to hopper.

The machine excels in simplicity as well as in capacity. It provides an ease and smoothness of grab bucket control . . . both in free digging and in barge clean-up operations . . . never before obtainable in a machine operating on alternating current.

When planning new unloading equipment, let our engineers send you full information on the distinctive Mead-Morrison features that can increase the speed and improve the efficiency of your ore, limestone and coal unloading.

MEAD-MORRISON

Division of McKIERNAN-TERRY CORPORATION . *Manufacturing Engineers*

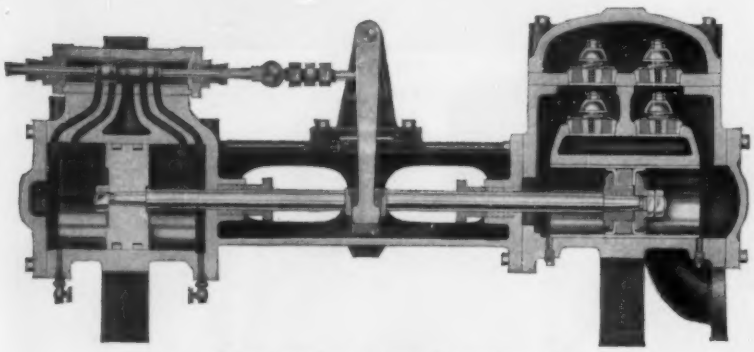
HARRISON, NEW JERSEY

95% Pumping Cost...

"For FREE"

Via WARREN "Realwear" Horizontal Duplex Steam Pump with Piston Valve Steam Chest

featuring special steam piston ring and steam chest piston valve ring construction, in addition to balanced steam chest piston valves and graphitic iron liners.



NOTE THESE ADVANTAGES:

- Oil-free exhaust steam.
- Clean exhaust steam for any purpose.
- Protection of boilers.
- No contamination of returns.
- Economy . . . 95% recovery of fuel cost when exhaust steam utilized.
- Reliability . . . not dependent upon electricity.
- Flexibility to meet varying load conditions with efficiency at all points.
- Adaptability to either manual or governor control and to long periods of shut-down, if necessary, without addition of oil or graphite.
- Elimination of any type lubricator.
- Outside valve adjustment.

This construction can save you money on Boiler Feed and all Steam Processing applications.

WARREN QUIMBY PUMPS

P-88

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC.

Warren, Massachusetts

WITH OUR READERS

Continued from page 214

POWER'S MICRORINGELMANN

"It seems to me that your MicroRingelmann chart should be quite practical in use. The Plibrico Co made a small modified Ringelmann chart, which I have used on a number of occasions. Both with theirs and with yours, I have found it convenient to punch a small hole about ⅛ or 3/16 in. in diameter in each of the darkened sections. Then, I use the large opening to bracket the area and the small holes for matching the chart with the smoke.

U B YEAGER, *Fuel Engineer*
Island Creek Coal Sales Co

EDITOR'S NOTE: *Our original thought was that the slot in the middle would aid in matching the chart grids with the smoke. Your idea of punching a small hole in each of the grid sections sounds like an additional convenience and we will pass it along to our readers.*

More PLANT PROBLEMS

Begins on page 148

Raising motor speed

Continued from page 152

REWIND and reduce the number of turns per phase, as follows: (a) Change coil pitch to 1 and (number of coils/number of poles) − 1. (b) Rewind each coil so new number of turns = (original rpm/desired rpm) (original number of turns). (c) Change wire size to (desired rpm/ original rpm) (original wire size, cm). (d) Use the same method of connection as in the original motor winding.

A J BREUGELMANS *New York, N.Y.*

More FREE BULLETINS

Begins on page 181

ELECTRICAL EQUIPMENT

18 **Tensors and transformer** connections. Descriptive 16-page bulletin O1R8169 discusses solution of network problems by tensor analysis. Allis-Chalmers Manufacturing Co, 952 S 70th St, Milwaukee, Wis.

19 **Heavy-duty rectifiers** with ratings to 500 kw. Illustrated bulletin HDR-854. Perkin Engineering Corp, 345 Kansas St, El Segundo, Cal.

20 **Solenoid contactors** with power ranges to 250 amp. Photos, dimensional drawings, and technical data in 6-page bulletin SC-9. Guardian Electric Manufacturing Co, 1621 W Walnut St, Chicago 12, Illinois.

HEAT EXCHANGERS, CONDENSERS

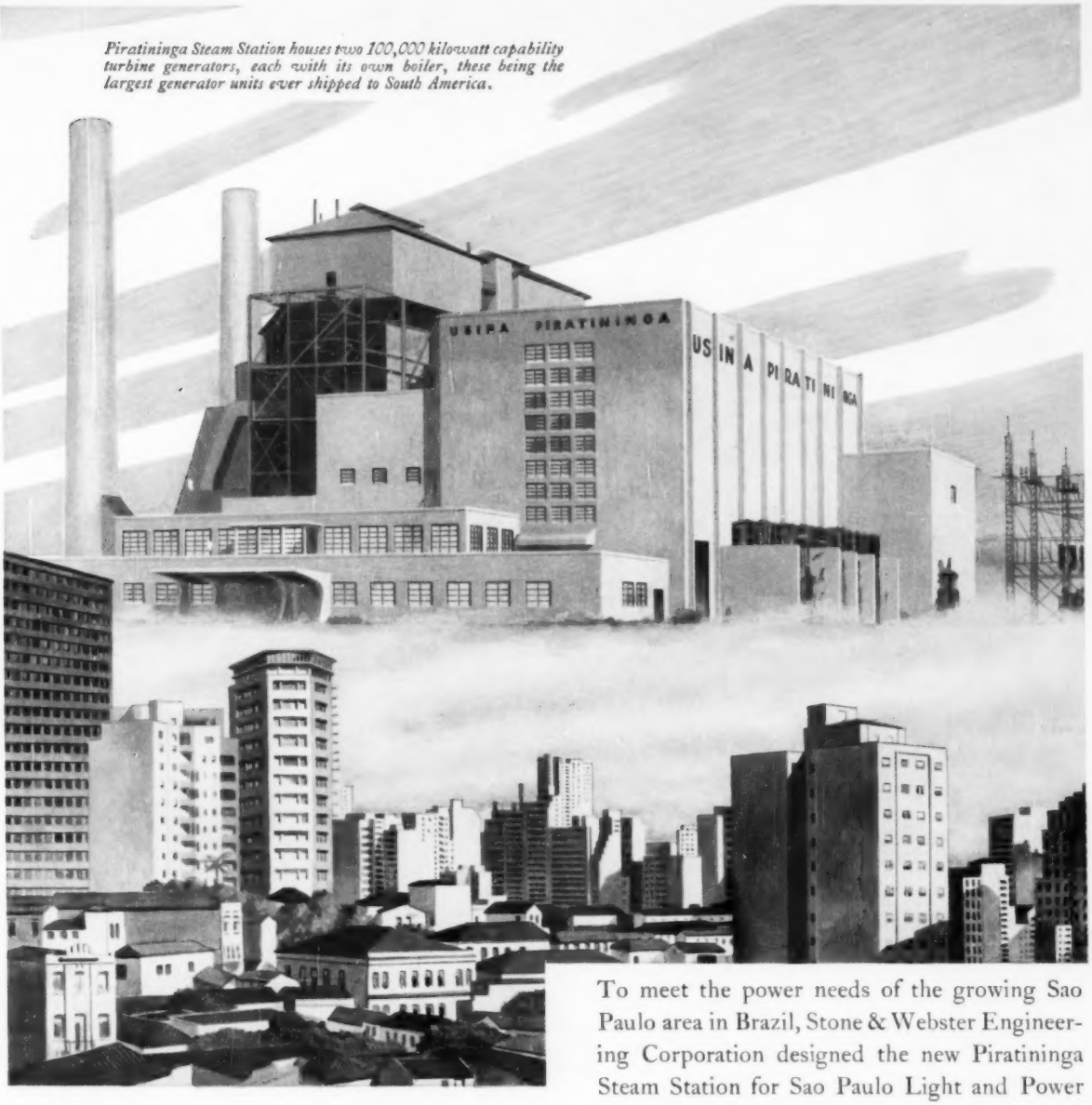
21 **Plate heat exchangers** for industry. Photos, diagrams, applications in 8-page bulletin. DeLaval Separator Co, Poughkeepsie, N. Y.

22 **Condenser and fluid cooler,** 400-ton capacity. Photos, diagram, applications in 2-page bulletin 123. Niagara Blower Co, 405 Lexington Ave, New York 17, N. Y.

23 **Surface condensers,** how they operate, their nomenclature and

(*Continued on page* 220)

Piratininga Steam Station houses two 100,000 kilowatt capability turbine generators, each with its own boiler, these being the largest generator units ever shipped to South America.



ACHIEVEMENT IN BRAZIL . . .

To meet the power needs of the growing Sao Paulo area in Brazil, Stone & Webster Engineering Corporation designed the new Piratininga Steam Station for Sao Paulo Light and Power Company, Limited, an operating subsidiary of the Canadian corporation, Brazilian Traction, Light & Power Company, Limited. Construction for the first unit, now in operation, was completed in a record time of 26 months by Stone & Webster Construction Company.

All available materials were purchased in Brazil, and the field forces, totaling over 1800 at the peak of construction, were recruited locally.

Write or call us for detailed information as to how our engineering, design, construction, report and appraisal services may be of assistance to you.

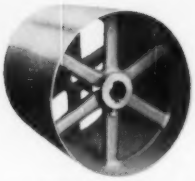
STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Seattle Toronto

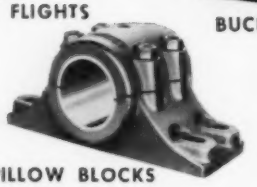
SCRAPER FLIGHTS

BUCKETS



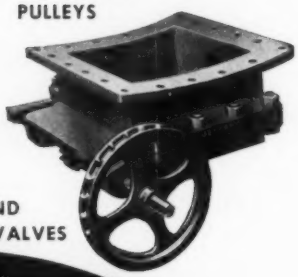
PULLEYS

ELEVATOR BOOTS



PILLOW BLOCKS

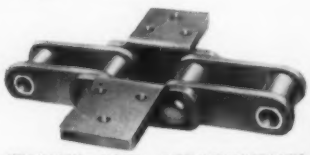
SPROCKETS



RACK AND PINION VALVES

SLATS

SLATS



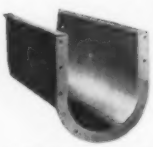
CHAINS AND ATTACHMENTS

Need replacements quickly? Standard parts carried in stock

Many large industrial concerns buy all their conveyor parts and accessory equipment from Jeffrey sales offices and distributors. You will find the complete Jeffrey line covers each item on your list.

A few of the standard units are shown here — they will help you speed production and cut costs.

Send for Booklet 832
which shows many types of Jeffrey stock parts.

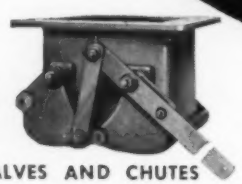


SPIRAL TROUGHS

SPIRAL FITTINGS

SPIRAL FLIGHTS

APRON FLIGHTS



VALVES AND CHUTES

BELT IDLERS

THE JEFFREY MANUFACTURING CO.

ESTABLISHED 1877

Columbus 16, Ohio

sales offices and distributors in principal cities

PLANTS IN CANADA, ENGLAND, SOUTH AFRICA

IF IT'S MINED, PROCESSED OR MOVED

. . .IT'S A JOB FOR JEFFREY!

From coast-to-coast, A. P. GREEN warehouse stocks are available for immediate delivery to your plant...

You Lower Your Capital Investment . . . Your capital is not tied up in warehouse space.

You Lower Your Inventory Costs . . . You have on hand only the refractories you need . . . immediately.

You Lower Your Inventory Losses . . . You buy on current prices . . . there's no danger of losing money due to price declines or breakage while in storage.

You Increase Production Space . . . By freeing storage space for more profitable use.

You Lower Labor Costs . . . A. P. Green refractories are delivered to the point of usage. There's no inplant moving by your workers.

You Maintain Steady Production . . . With less down time. A. P. Green warehouse stocks are complete and are available for immediate delivery.

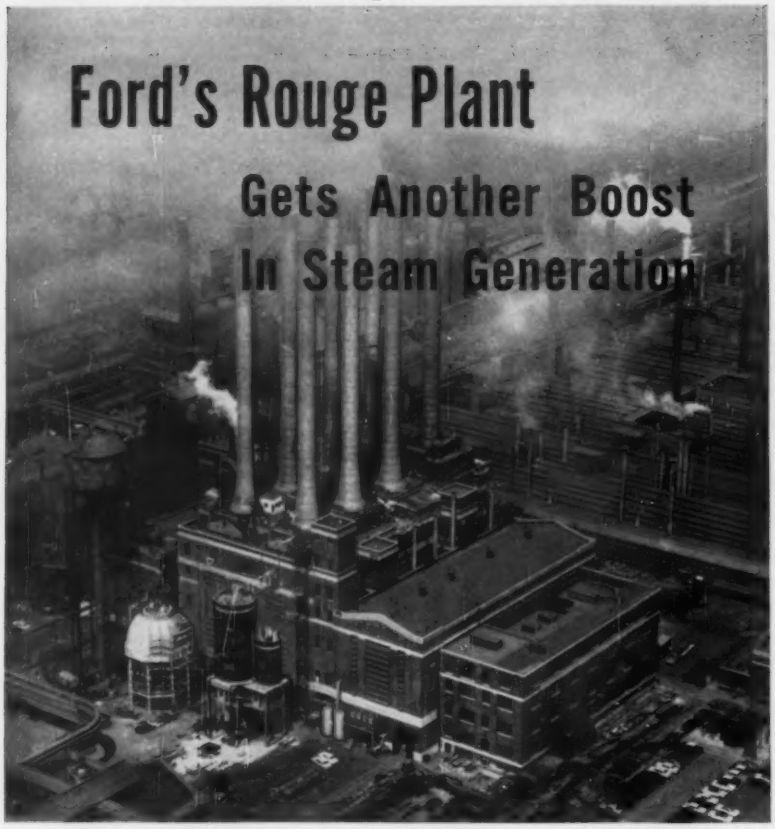
THERE'S AN A. P. GREEN WAREHOUSE STOCK NEARBY

...to Save You Money Six Ways

Look in the classified section of your telephone directory or write for the name of the A. P. Green distributor in your locality.

A. P. Green REFRACTORY PRODUCTS

A. P. GREEN FIRE BRICK COMPANY
Mexico, Missouri, U. S. A.
PLANTS: Mexico, Mo. • Woodbridge, N. J. • Sulphur Springs, Texas
In Canada: A. P. GREEN FIRE BRICK COMPANY, LTD.
Toronto 15, Ontario



The Rouge Power Plant has kept more continuously abreast of progress in the fields of fuel burning and steam generation than any other plant in the world. In fact, since its construction in 1920, it has always had a greater steam capacity than any other industrial power plant.

FORD MOTOR COMPANY has taken another step forward in the modernization of its facilities by installing three of the largest low pressure steam generating units in industry. The new units, capable of producing a total of up to 1,800,000 pounds of steam per hour, are replacing the low pressure units at the Rouge Power House. The new installation makes possible highly efficient utilization of all available blast furnace gas as well as other fuels.

The Kuljian Corporation was awarded contracts by the Ford Motor Company for the design, engineering, procurement, and construction phases of the entire project.

Included in this latest move to modernize, the Rouge Power Plant is also being provided with complete facilities for a new 200,000 gallons per hour hot lime zeolite water treatment system, including a 1,500,000 pounds per hour deaerating heater; complete fly ash and bottom ash handling equipment; and a fly ash collection system . . . all installed *without interruption* of normal plant operation.

Kuljian is proud to play a part in the steady progress of one of the world's largest and best known industrial power plants.

The Kuljian Corporation

engineers • constructors

1200 North Broad Street • Philadelphia 21, Penna.

MEXICO CITY • CARACAS • BOGOTA • MADRID • ATHENS • BEIRUT • TOKYO • CALCUTTA • RANGOON

More FREE BULLETINS

Begins on page 181

definitions described in 20-page booklet 19B8201. Allis-Chalmers Manufacturing Co, 952 S 70th St, Milwaukee, Wisconsin.

24 **Tube expanders** for condensers and heat exchangers. Full data on selection, dimensions in 8-page bulletin Y-38. Elliott Co, Lagonda div, Springfield, Ohio.

MAINTENANCE MATERIAL AND EQUIPMENT

25 **Service bulletin,** "Give the Cooling System a Chance." Illustrated 12-page bulletin 19 contains practical suggestions and cartoons on care of engine's cooling system. Cummins Engine Co, Inc, Columbus, Ind.

26 **Sash maintenance.** Caulking, glazing, painting, sill restoration, etc, discussed in illustrated 16-page bulletin. The Tremco Manufacturing Co, 8701 Kinsman Rd, Cleveland 4, Ohio.

27 **Roof maintenance** packages, for repairs or resurfacing. Illustrated 4-page bulletin. Lexsuco Inc, 4815 Lexington Ave, Cleveland 3, Ohio.

28 **Chromium plating process.** *Porus-Krome* for application to cylinder bores and other bearing surface to produce pores for holding lubricating oil. Illustrated 12-page question-answer bulletin. Van Der Horst Corp, Olean, New York.

29 **Grouting** for heavy equipment with *Embeco* non-shrink mortar. Illustrated 16-page folder outlines grouting methods, types of equipment, mixing and placing of grout, etc. The Master Builders Co, 7016 Euclid Ave, Cleveland 3, Ohio.

30 **Magnetic screw holding** accessories for power screw drivers and nut setters. Selection tables, specs in 24-page manual. Magna Driver Corp, 779 Washington St, Buffalo 3, New York.

★ **Plant maintenance** cleaning guide. Twelve-page 7x8½-in. booklet contains how-to charts, photos, procedures. ★Request direct on company letterhead. Oakite Products, Inc, 123 Rector St, New York 6, N. Y.

31 **Shock and vibration** isolators *Series 5200.* Features and uses in 8-page bulletin 541. Barry Corp, 1000 Pleasant St, Watertown, Mass.

MATERIALS HANDLING

32 **Overhead bridge cranes.** Photos, specs, applications of single, double and box girder cranes in 6-page bulletin 154. The Michigan Crane & Conveyor Corp, 115 N McKinstry Ave, Detroit 9, Michigan.

33 **Hydraulic crane,** for indoor and outdoor use. Photos, specs, performance data, in 8-page bulletin AD-2253. Austin-Western Co, 601 Farnsworth Ave, Aurora, Ill.

34 **Electric hoist,** 4 to 15-ton capacities. Photos, cutaway view, performance data in 6-page bulletin. R G LeTourneau, Inc, Longview, Texas.

35 **Ball bearing trolley** *Series 500* for overhead conveyors. Photos, specs, selection data in 20-page bulletin 2536. Link-Belt Co, 307 N Michigan Ave, Chicago 1, Ill.

MECHANICAL TRANSMISSION

36 **Variable speed drive** with ratios to 3:1. Drive selection, tables, dimensions in 8-page bulletin 497. T B Wood's Sons Co, Chambersburg, Pa.

37 **Flexible coupling units.** Specs, photos, cutaway in two data sheets FS41-54. Morse Chain Co, 7601 Central Ave, Detroit 8, Michigan.

38 **Adjustable speed equipment.** Company's complete line of drives, couplings, brakes, etc described in illustrated 16-page bulletin GB2. Dynamatic division, Eaton Manufacturing Company, Kenosha, Wisconsin.

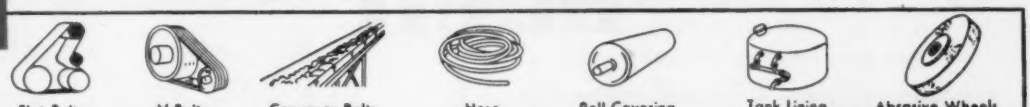
(*Continued on page 222*)

R/M CONVEYOR BELTS

If conveyor belts are your problem, turn to Raybestos-Manhattan. There are R/M Conveyor Belts with extra cushion for heavy shock loading. R/M Conveyor Belts for mining, quarrying, or bulk materials are unequalled for natural troughing, flexibility and long life. The latest exclusive development of R/M engineers is the "XDC" cover which protects heavy duty conveyor belts against wear, abrasion, cuts and tears to a degree never before attained. Hot material, high tension, long lift, oil or non-spark conditions . . . all are met with special R/M Conveyor Belt designs. Equally good engineering goes into R/M Belts for light duty . . . packages, parts, cases or wood chips. For every use R/M Conveyor Belts give you More Use per Dollar. Consult an R/M representative. Ask him also about R/M Hose, Transmission, V-Belts and other industrial rubber products.

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.



Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings
Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Bowling Balls RM-417

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Buell offers you a unique opportunity to eliminate nuisance dust problems . . . without risking a single cent!

Many of America's Leading Corporations have already taken advantage of this 'red hot proposition'. Why don't you?

Just call in a Buell Engineer and put your problem in his hands. First, he will analyze dust samples from your stack, then make a thorough study of operating conditions. Finally, he will recommend the best Buell equipment to handle *your* job.

There are many variables that make each job different. One may require the fabulously successful Buell 'SF' Electric Precipitator. The simple design and proved efficiency of the Buell Cyclone may suffice for another. A third may require a combination.

The *right* equipment plus over twenty years of skill and experience enables Buell to handle *any* dust collection problem.

Take advantage of this 'red hot proposition' now. Get the complete facts about all *three* Buell systems described in our brochure—The Collection and Recovery of Industrial Dusts. Write Dept. 50-L, Buell Engineering Company, 70 Pine Street, New York 5, N. Y.

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MECHANICAL ELECTRICAL

20 Years of Engineered Efficiency in
DUST COLLECTION SYSTEMS

More FREE BULLETINS

Begins on page 181

METERS AND INSTRUMENTS

39 **Process instrumentation.** Photos, descriptions, specs of company's line of flow meters, temperature controllers, etc in Catalog 1. Fischer & Porter Co, 172 Jacksonville Rd, Hatboro, Pennsylvania.

40 **Self-balancing indicator** for rapid reading or logging of many temperatures. Single-sheet bulletin 61. Thermo Electric Co, Inc, Saddle River Twp, Rochelle Park Post Office, N. J.

41 **Miniature recorder** and controller for process variables such as temperature, pressure, flow and liquid level. Photos, specs, operation data in 12-page bulletin 7201. Minneapolis-Honeywell Regulator Co, Wayne & Windrim Aves, Philadelphia 44, Pa.

42 **Oscillograph,** direct writing. Construction, specs, operating principles described in 8-page illustrated bulletin. Offner Electronics Inc, Dept M, 5320 N Kedzie Ave, Chicago 25, Ill.

PIPING, VALVES, FITTINGS AND SPECIALTIES

43 **Vitrified tile conduit** for underground insulated piping. Construction features, cutaways, engr data, tables in 12-page bulletin 54. Universal Sewer Pipe Corp, Steam Conduit div, 1500 Union Commerce Building, Cleveland 14, Ohio.

44 **Stainless steel pipe,** seamless or welded. Dimensions, weights, applications in 6-page bulletin TB-356. The Babcock & Wilcox Co, Tubular Products div, Beaver Falls, Pa.

45 **Automatic control valves** for process requirements. Photos, cutaways, specs in 40-page catalog CV53. Kieley & Mueller, Inc, Middletown, New York.

46 **Regulating devices.** Photos, specs of reducing, relief and float valves. Four-page bulletin 2. Atlas Valve Co, 280 South St, Newark 5, N. J.

47 **Hand- foot-operated valves** *600* and *880 series.* Installation data, exploded views, applications in 20-page bulletin 303-B. Ross Operating Valve Co, Dept 3006, 120 E Golden Gate, Detroit 3, Michigan.

48 **Safety valves.** Photos, selection table, specs in 4-page bulletin 194-A. Frick Co, Waynesboro, Pa.

49 **Mudline valves.** Photos, specs, applications in 16-page bulletin 543. Edward Valves, Inc, 1201 W 145th St, E Chicago, Indiana.

50 **Air traps** for automatic drainage of water from compressed air intercoolers, after-coolers, separators, drip points. Methods of selection and installation described in illustrated 4-page bulletin 2022. Armstrong Machine Works, Three Rivers, Michigan.

51 **Self-flaring fittings.** Photos, cutaway, construction data in two-page bulletin. Century Products, 315 S 15th St, Philadelphia 2, Pennsylvania.

52 **Installation accessories** for lubrication, hydraulic, steam, liquid and air applications. Includes adapters, couplings, nipples, hose fittings, clamps, etc. Fifteen-page catalog 17-D. J N Fauver Co, Inc, 49 W Hancock, Detroit 1, Michigan.

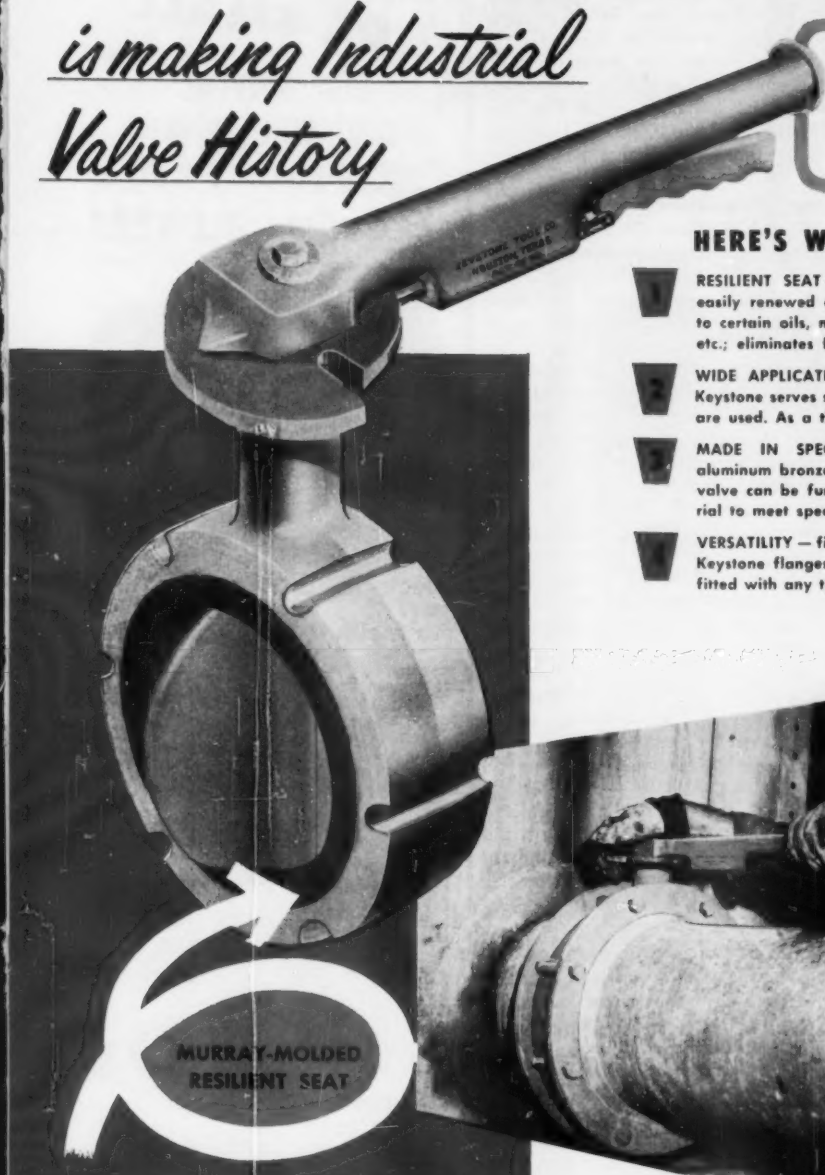
★ **Fire hose and fittings** for industrial use. Photos, specs, construction data, recommended use, working pressures in 8-page bulletin. ★Request direct on company letterhead. Boston Woven Hose & Rubber Co, PO Box 1071, Boston 3, Massachusetts.

Preliminary work is under way on the Battle River, near Forestburg, Alberta, on construction of a $6.5 million hydroelectric project for Canadian Utilities, Ltd.

KEYSTONE, the Key to better Butterfly Valve Performance . . .

is making Industrial Valve History

See this unique valve at
Booth 740
21st National Exposition of Power
and Mechanical Engineering,
Philadelphia — Dec. 2-7



HERE'S WHY:

1. **RESILIENT SEAT** — seals tightly under pressure or vacuum; easily renewed at low cost; available in materials resistant to certain oils, many chemicals, high temperatures, abrasion, etc.; eliminates flange gaskets.
2. **WIDE APPLICATION** — unlike ordinary butterfly valves, the Keystone serves satisfactorily wherever gate and globe valves are used. As a throttling valve it is unexcelled.
3. **MADE IN SPECIFICATION MATERIALS** — malleable body, aluminum bronze disc, and steel stem are standard, but this valve can be furnished in any desired metal and seat material to meet specific requirements.
4. **VERSATILITY** — fits standard out-of-stock flanges or special Keystone flanges; optional gear or lever operation; may be fitted with any type operator for automatic or remote control.

Proved in hundreds of services in less than three years, including: alcohol, alkalis, antitoxins, bromine, calcium carbide, dry blown cement, cement slurry, chemicals, clay, cottonseed oil, coal, dyes, beer, food, drugs, explosives, fertilizers, fibre products, pulp, insecticides, lime, lye, magnesia, salts, soap, rubber, molasses, oil, brine, caustic soda, and others too numerous to mention.

MURRAY RUBBER COMPANY
HOUSTON, TEXAS

The Keystone Butterfly Valve is manufactured by the

Keystone Tool Corporation

P. O. Box 6716, Houston 5, Texas
Write for Keystone Bulletin No. 5-A
Murray furnishes the resilient seat only

products side-by-side

Push the buttons, pull the handles, get the heft. Make on-the-spot comparisons of the plant maintenance and engineering products, services, supplies and machines you need to keep your plant running at top speed.

GO

to **compare**

And there's only one place where you'll find them all displayed – over 400 exhibits – at the Plant Maintenance and Engineering Show. In all the other days of the year, you can't begin to compare so many competitive products – products that can save your plant money and time, and step up efficiency.

Schedule time, too, for the Plant Maintenance & Engineering Conference. It will be attended by and led by the top men in their fields. Send the coupon today for Show tickets, and conference information.

6th National Plant Maintenance & Engineering Show & Conference

International Amphitheatre, Chicago
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Please send me free tickets for the 6th National Plant Maintenance & Engineering Show and information on the Conference.

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More TECHNICAL BRIEFS

Begins on page 168

as $130 per kw, while a nuclear plant of the same capacity would cost $300 per kw. Energy cost in the conventional plant would be 6.5 mills per kwhr; in the nuclear plant 6.2 mills per kwhr. Net fuel cost for the nuclear plant is 0.2 mills per kwhr. Fuel consumption rate is 0.000031 lb U-235 per million Btu. *AIF paper; no number.*

Approaching atomic power. *By Eugene B Hotchkiss, Vitro Corp of America.*

One might say there are three generations of reactor development. The first takes in reactors built and operated since the AEC's program began rolling in 1948.

Second generation is the group of reactors now being designed and built under AEC's five-year plan, each of which represents a possible route to an economic power plant. Third generation should be one of true power reactors, economically competitive with conventional steam-generating plants. These reactors are not yet on the drawing boards and probably will not be until at least some of the returns from the second generation are in and counted.

The law related to atomic energy is going through a parallel development. Though the third generation of atomic law will not be reached until we cross the threshold of atomic power—probably by 1964, perhaps sooner—lawyers and legislators are gaining much valuable experience. Many business and engineering phases of present and future problems are also covered by this paper. *AIF paper; no number.*

The hazards of nuclear power plants. *By George L Weil, consultant.*

Reactors are expensive and hazardous. A much greater degree of caution and control must be exercised in their design and operation than for usual industrial machines. Though realistic information based on experience is lacking, those designing and operating nuclear power plants must make the most pessimistic assumptions with regard to potential accidents and their consequences.

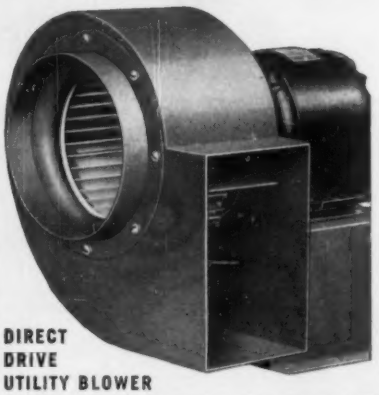
Two factors making nuclear power plants hazardous are the contained radioactive materials, fission products and fuels, and the fact that the plant will contain, under certain circumstances, considerably more fissionable material than the critical amount.

If a reactor gets out of control, its power output and temperature can rise rapidly. Best calculations of expected

Directions for ordering papers on p 236

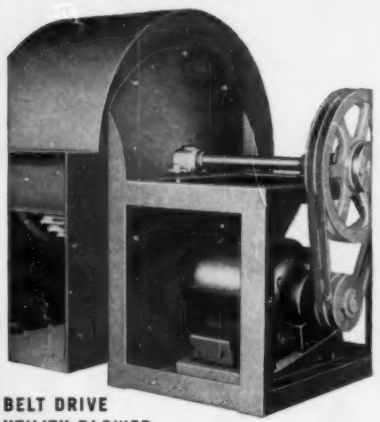
BIG OR SMALL

Air-moving problems solved economically with *Peerless* BLOWERS



DIRECT DRIVE UTILITY BLOWER

Compact; easy-to-mount; quiet; arc-welded; weatherproof covers; matched motor; fully guaranteed by Peerless.



BELT DRIVE UTILITY BLOWER

Arc-welded; sleeve or ball-bearing; convertible housing; adjustable speeds; fully guaranteed by Peerless.

● Let your Peerless dealer show you how to move smoke, fumes, or dirt and dust laden air from your plant or shop economically. He knows his business and gets additional help from our engineers. Initial low cost and trouble-free service assure long-time satisfaction. You can't buy better than Peerless. Write for dealer nearest you.

Peerless Electric

THE PEERLESS ELECTRIC COMPANY
FAN AND BLOWER DIVISION
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These three fine H. J. Heinz products produced in plant equipped with WICKES BOILERS

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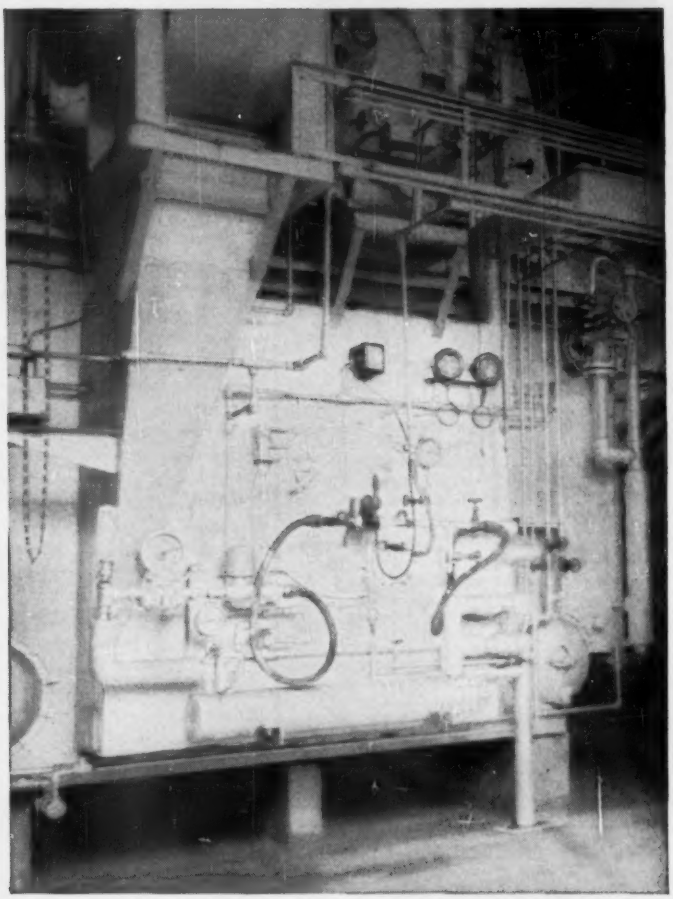
Wickes will design and build water-tube steam generators for any practical size and pressure. Wickes also offers a wide choice of auxiliary equipment so that you can get not only the best steam generator, but also the best correlated equipment. Consult your nearest Wickes representative or write us today.



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More TECHNICAL BRIEFS

Begins on page 168

blast effects from a run-away reactor under these conditions, show the blast effect would be very small. Outside the reactor building its direct effects would be negligible.

In the maximum possible accident when the reactor structure is ruptured, a large fraction of fission products, perhaps 50%, are released in the form of a cloud that escapes from the reactor building into the atmosphere immediately above. Radiation from this cloud would be lethal to a large fraction of plant personnel who could not be evacuated in the short time available between accident and cloud appearance.

The paper discusses these and other effects and suggests a number of safety measures that might be used to reduce injuries to persons in the area. *AIF paper; no number.*

Lubrication

What type of grease for that application? *By W A Magie II, Magie Brothers Oil Company.*

Performance, simplification, and cost are the three most important considerations in selecting the proper type of grease for steel-mill application. No particular type is favored—such as calcium, sodium, lithium, barium or bentone, nor is it felt that an all-purpose or multi-purpose grease for steel mills is yet practical or economical.

Several laboratory performance tests rather than straight physical or chemical tests of different grease base types are reviewed. Plasticity characteristics at elevated temperatures are felt to affect the field performance of each type of grease in respect to bearing retention rather than drop points. The author refers to the accepted belief that grease is not much better than the oil in it, so that with petroleum oils regardless of drop point of the product or type of soap from which it is made, a safe operating temperature is close to 200 F. It is pointed out that in rolling-mill operations, grease must have good wear characteristics as well as ability to withstand extreme pressure. Non-soap type greases do not make economical extreme-pressure lubricants, based on the author's own manufacturing experience.

Four distinct soap-type greases are suggested to properly cover solid lubricant requirements in steel mills, with winter and summer grades in each case. We have all-weather or multi-grade motor oils but to date the use of high-viscosity index oils and viscosity-index improvers in grease has not accom-

Directions for ordering papers on p 236

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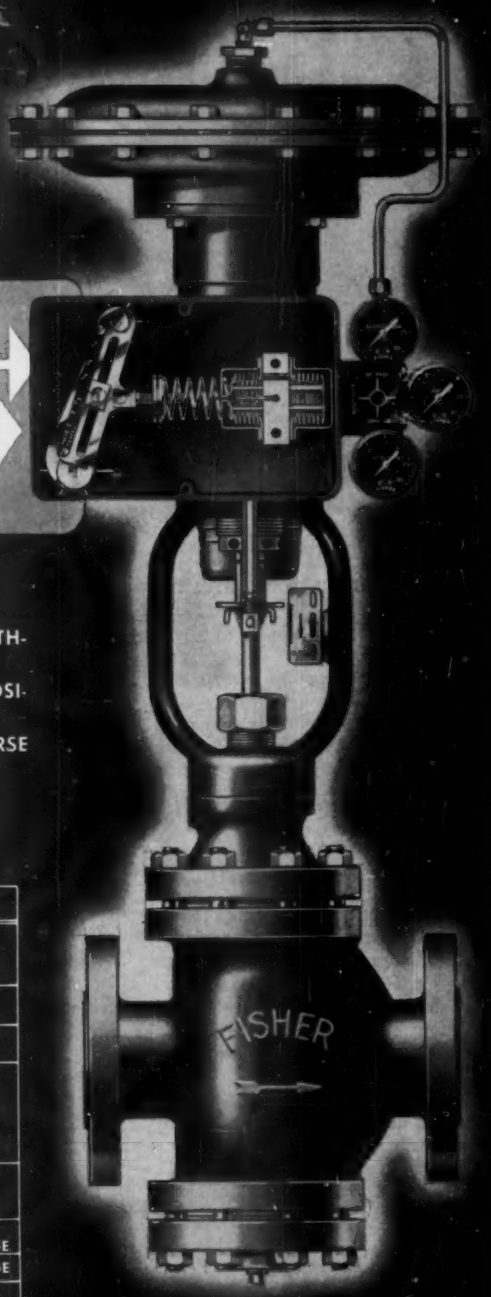

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TEST			FISHER TYPE 3500
INSTRUMENT PRESSURE SENSITIVITY CONTROLLING PRESSURE CHANGE NEEDED TO PRODUCE 2 LBS. TO 15 LBS. TO DIAPHRAGM			0.07 LB
STEM MOVEMENT SENSITIVITY AMOUNT STEM CHANGE TO PRODUCE 2 LBS. TO 15 LBS. TO DIAPHRAGM	½" TRAVEL		0.0037" AVE.
	2" TRAVEL		0.015" AVE.
SPEED TIME IN SECONDS FOR FULL TRAVEL	SIZE	TRAVEL	
	DD	¼"	1.2 — 1.2 SEC.
	FF	1½"	4.2 TO 4.8 SEC.
	GG	2"	7.2 SPC TO 9.6 SEC.
	HH	2"	10.5 TO 12.6 SEC.
LAG ERROR IN POSITION AT 9 LBS. CONTROLLER PRESSURE	½" TRAVEL		0.0006" AVE.
	2" TRAVEL		0.001" AVE.
EFFECT OF VARIATIONS IN AIR SUPPLY PRESSURE	½" TRAVEL		0.1 LB. PER 5 LB. CHANGE
	2" TRAVEL		0.1 LB. PER 5 LB. CHANGE
CHARACTERISTICS CONTROLLED P VS DIAPHRAGM P			LINEAR
COMMENTS			STABLE ADJUSTMENTS ALL EASY AND SIMPLE
AIR CONSUMPTION NORMAL 9 LBS. DIAPHRAGM PRESSURE			15.0 CU FT/HR

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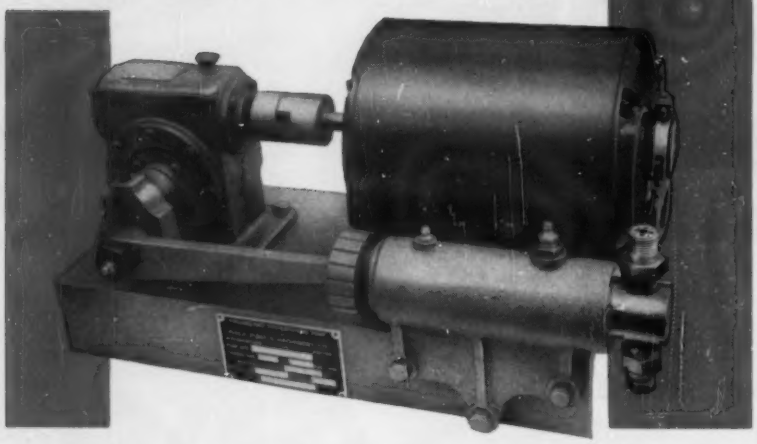

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More TECHNICAL BRIEFS

Begins on page 168

plished the same end result. Any thermoplastic material such as grease is affected by temperature changes in degrees of plasticity or body while an oil is affected in degrees of viscosity. Further research is urged to develop all-weather greases so that we can have good pumpability at low temperatures with small changes in plasticity or body at high temperatures, and still maintain the superior characteristics of a grease that will adhere, withstand pressure, inhibit rust. *AISE paper; no number.*

Bearing maintenance for economy. *By John A Toth, Bantam Bearings Div, The Torrington Company.*

Steel-mill operations can no longer neglect to recognize progress that has been made in anti-friction bearing engineering development and manufacturing. Industry is now faced with the problem of lower unit cost. This cost may be controlled in many ways, but application and maintenance of anti-friction bearings in steel-mill equipment is very important because of capital investment involved.

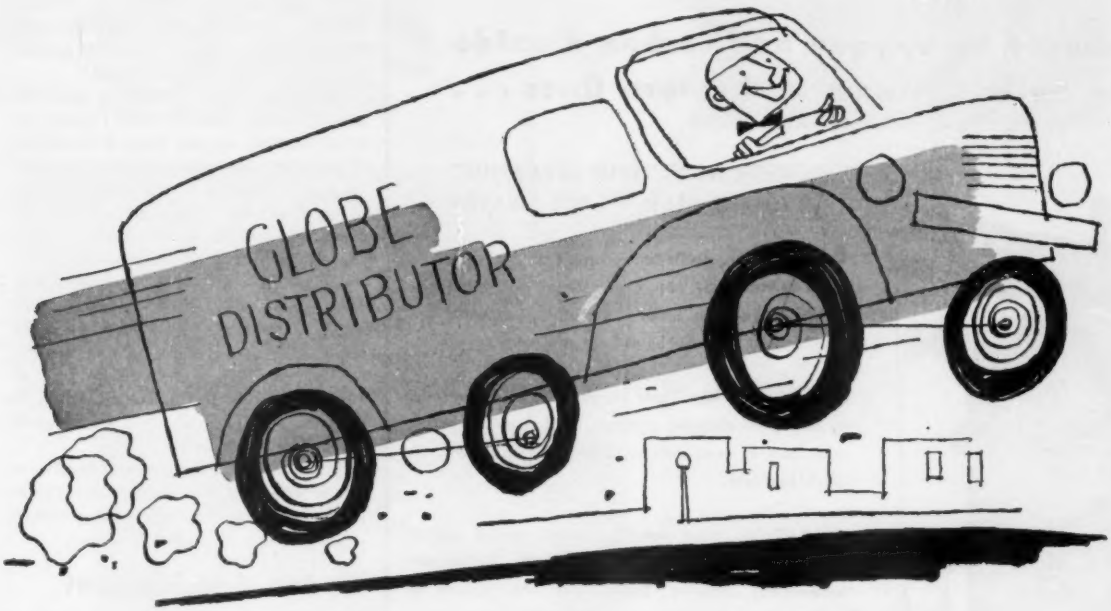
Economy can only be related to bearing applications when continuous operation or performance for maximum service life expectancy is obtained from the bearing. From an engineering point of view, many types of anti-friction bearings can be designed in proportions to meet the condition of loads that may be primarily radial or thrust. In many instances, limitations are introduced because of available space. Selection of the bearing can be carefully made not only by mathematical analysis, but particularly based on actual service-life experience.

To make a life prediction for anti-friction bearings, it is necessary to evaluate conditions of operation in terms of their effect upon the bearings. Factors that enter into this problem are: load, speed, conditions of smooth or shock operation, corrosion influences, accuracy of members adjacent to the bearing, temperature, and particularly lubrication. These factors may be easily formulated in many cases, while others present greater difficulties. Frequently the presence of errors in assessing these values causes considerable disagreement between computed and actual life of a bearing installation. It is at this stage that proper engineering analysis and experience is mandatory in proper selection of bearing types and sizes.

It is possible to predict with surprising accuracy the average life of a group of bearings. This permits application of the law of averages. Obviously, the

Directions for ordering papers on p 236

When you need welding fittings...



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Stop Corrosion

caused by oxygen and carbon dioxide in boilers, steam and return lines . . .

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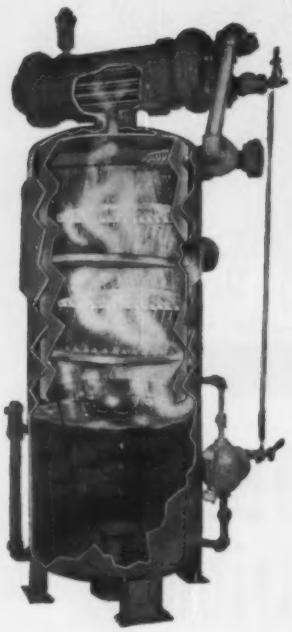

The new Stickle Baffle Spray Type Feed Water Heater stops corrosion by removing destructive oxygen and carbon dioxide from boiler feed water . . . reduces fuel costs and boiler strain by preheating feed water.

SELF-CLEANING There are no loose baffles or trays to remove for cleaning or repair. "Self-cleaning" action takes care of small amount of lime and other minerals which may form.

OPERATION Feed water is sprayed upward against special hood, falls in mist on top baffle. Baffles are permanently installed. Semicircular, they extend in gradual slope to straight upturned serrated edge. Water cascades over edges in series of thin streams. Steam sweeps upward, carrying with it non-condensable gases. Vent condenser prevents steam waste.

CAPACITIES Capacity range in the various models is 3,000 to 300,000 pounds of preheated feed water per hour.

This Stickle unit is the latest development in more than 50 years of building feed water heaters. It is engineered to individual specifications, and guaranteed to obtain predetermined results. *Write for new folder S-217.*

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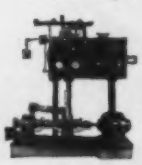

Differential Drainage and Boiler Return Systems

Regulating and Reducing Valves

More TECHNICAL BRIEFS

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larger the group, the more accurate will be the prediction. Statistical data taken from actual laboratory tests, as well as service experience with anti-friction bearings, indicates that approximately 10% of the bearings in a group are not predictable for life expectancy.

Abnormal load conditions and improper fitting practice will rapidly reduce bearing service life. A condition of misalignment will not permit applied load to be carried by the whole bearing so that related increased stresses on the bearing elements will introduce premature fatigue and ultimate failure.

Basically, lubrication has been established as a critical factor for good bearing performance. Use of heavy consistency lubricants is not desirable because of the possibility of channeling. Lighter consistency lubricants such as semi-fluid greases, oils, and oil-mists assure good bearing performance.

These briefed factors are indicative of the attention necessary to guarantee good bearing performance for economy. *AISE paper; no number.*

Hydro development

The influence of tropical and sub-tropical factors in the design of hydroelectric plants. *By J K Sexton.*

Hydroelectric design in tropical and sub-tropical regions as compared to practice in temperate regions is influenced by the high temperatures, extremes of humidity, hurricane winds, high floods, wide variation of streamflow, scarcity of natural storage, and the silt-laden river water frequently encountered in these areas.

Water power in the tropics is usually subordinated to irrigation and most large projects are jointly developed to serve both purposes. However, the greater part of hydroelectric development to date has consisted of small single-purpose plants whose popularity is due in part to greater simplicity of design, possible where there is no possibility of freezing. Introduction of automatic and remote-controlled operation may further improve the position of these small plants.

Design of the various hydraulic structures comprising a power plant—reservoirs, dams, intakes, canals, flumes, pressure conduits and surge tanks—is simplified by absence of ice but complicated by high floods and presence of silt in the water.

There is little difference in building design and mechanical equipment in hot and cold climates. But design of electrical equipment in the tropics must be

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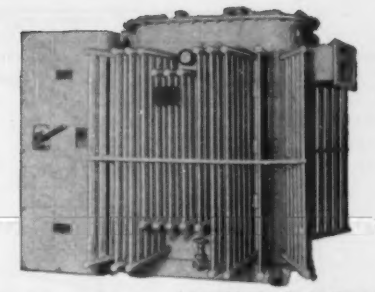

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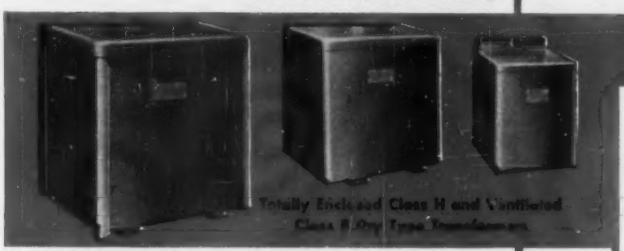

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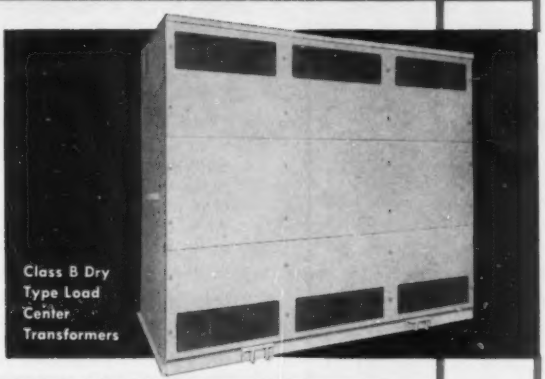
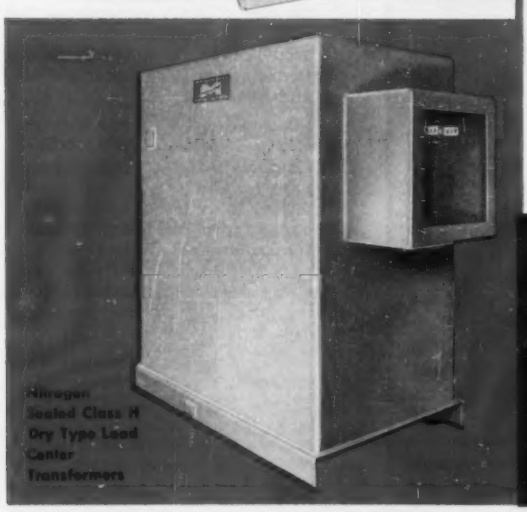


Class B Dry Type Load Center Transformers



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Protect your plant against heart failure. Install dependable Moloney Load Center Transformers and be assured of an uninterrupted flow of power under all operating conditions.

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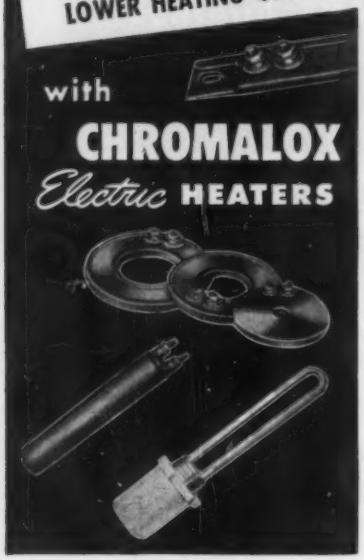

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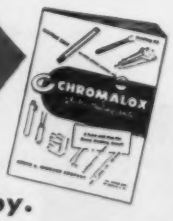

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adapted to high temperatures and humidity extremes. Underground powerhouses sometimes offer the best means of protecting equipment from super floods to be expected occasionally on tropical rivers. *WPC paper; no number.*

The federal multi-purpose project—its role in the West. *By Henry B Taliaferro, Chief, Power Div, U. S. Bureau of Reclamation.*

Perhaps the most significant milestone in western development of multipurpose projects was construction of Hoover Dam. Until its construction, the Colorado River periodically destroyed or flooded fertile lands in southern California's Imperial Valley. Water flow was generally of little value for growing crops.

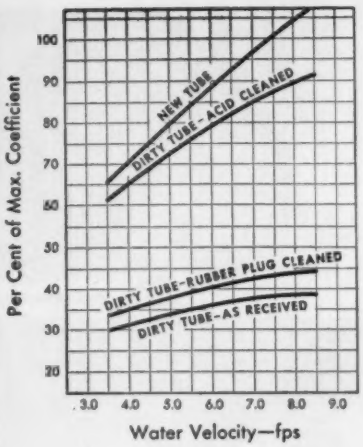
This has been completely changed by the Boulder Canyon project. Although Hoover Dam and power plant are renowned for their power production, the project has magnificently succeeded in other respects. Since the dam was closed no flood has threatened the lower valley. At the same time, regulated release of water provides the Imperial Valley with a stable water supply, making it one of the world's most favorable areas for growing special crops.

Production of electric energy has been nearly 5-billion kwhr a year since power delivery was started, including the early years of reservoir filling. This power is produced at one of the lowest rates in the country. Yet present revenues ensure payment of dam and power-plant costs in 50 years, except for a $25 million flood-control allocation. This item is expected to be paid for from power revenue within a few years following the amortization of the rest of the cost.

The greatest assured benefits with the lowest corresponding cost are best obtained by completely integrated and coordinated developments. Small isolated incomplete projects generally waste much of the potential benefits, while large-scale multi-purpose developments permit much nearer 100% use of potential benefits.

The Colorado-Big Thompson project in northeastern Colorado is an example of the value of such coordinated and interconnected developments. This project is known as the transmountain diversion, because Colorado River waters on the western slope of the Rocky Mountain Continental Divide are collected in a reservoir. From there they pass through a 13-mile tunnel under the Continental Divide. Emerging on the

Directions for ordering papers on p 236



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90% of surface condensers do not perform as well as they should. One major cause is fouled tubes. And, only too often, when such tubes are rubber-plug cleaned, the results prove far from satisfactory.

In a recently reported test, it was shown that shooting rubber plugs through a fouled tube didn't fill the bill in successfully removing the type of scale encountered. See chart. But when the same tube was acid-cleaned, the heat transfer obtained approximated that of a new and clean tube.

Removing lime scale with that effective acid-descalant, Oakite Compound No. 32, more than repays for itself by the savings it makes in reduced turbine-steam consumption and lower fuel costs. It minimizes tube failure caused by partially obstructed tubes and eliminates the cost both of replacing tubes and of idle condenser capacity.

After you have removed lime scale with Oakite Compound No. 32, you can prevent further build-up by treating condenser circulating water with Oakite Airefiner No. 52. For further details, write for booklet. No obligation. Oakite Products, Inc., 23 Rector Street, New York 6, New York.

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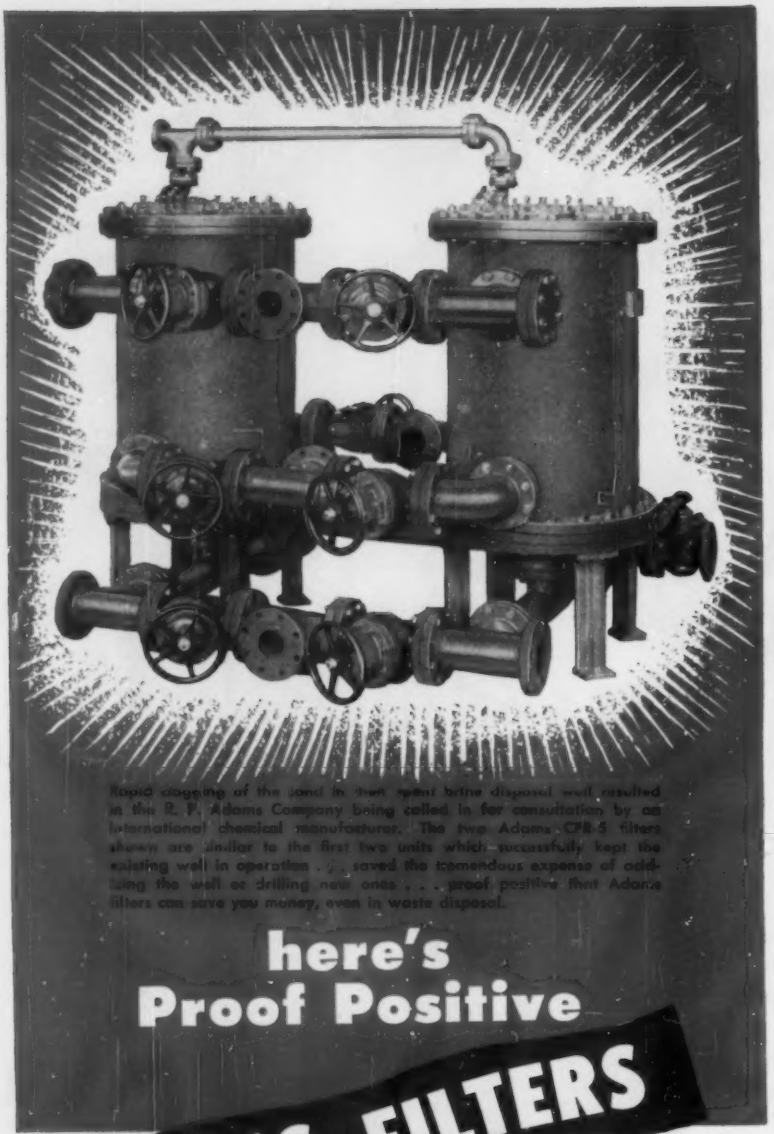

Rapid clogging of the sand in their spent brine disposal well resulted in the R. P. Adams Company being called in for consultation by an international chemical manufacturer. The two Adams CFR-5 filters shown are similar to the first two units which successfully kept the existing well in operation . . . saved the tremendous expense of additional wells or drilling new ones . . . proof positive that Adams filters can save you money, even in waste disposal.

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More TECHNICAL BRIEFS

Begins on page 168

eastern side, the water drops about 2000 ft through four power plants in tandem and into foothill reservoirs, from which it is distributed to the irrigation system of rich land, which has heretofore not produced to the full because of water scarcity.

The soundness of Reclamation developments is apparent in such a wide variety of nationally important attainments that it emerges as one of Uncle Sam's most worthwhile investments. The total cost of property and equipment from inception of the program to June 30, 1952 aggregated $2.1-billion, including half a billion for construction. Thus, accomplishments of Reclamation's half century are based on completed work costing approximately $1.75-billion.

The lands served by these developments produce crops with an annual value of nearly a billion dollars. The widened tax base from land made productive is almost incalculable. At the same time, over half a billion dollars have been paid into the U. S. Treasury by water and power users. *APC paper; no number.*

The role of the corps of engineers in water-resource development. *By Brigadier-General E C Itschner, Corps of Engineers.*

The Corps of Engineers received its first waterway assignment in the 1820's. At that time it was the only organized body of engineers in this country and its headquarters at West Point was the only engineering school in America. So the government turned to the Corps for development tasks like opening the Ohio River to keel-boat traffic, building roads over eastern mountains, and surveying the West. It has been in the resource development business ever since.

Today, the entire length of the Ohio River is canalized. It is carrying 56-million tons of freight annually, much of which is vitally important to the steel industry. The entire Mississippi Basin embraces one comprehensive plan for flood control, navigation improvement, and related purposes. It will cost $1,250,000,000 to complete authorized work. On the Missouri, the Corps is helping to transform one of the most troublesome streams in the world into a beneficial resource that will serve one-sixth of continental United States.

In the Columbia Basin, the Corps is participating in a comprehensive federal river development program that has stimulated growth of new industrial regions. Multiple-purpose projects under construction will have installed

Directions for ordering papers on page 236

Actual Figures... *NOT Claims*

Prove that AMERICAN "WC" coal crushers are top performers at low operating costs!

CRUSHING FACTS
based on User-Reports from
12 Power Plants & Coal Mines

Total Tonnage Crushed:
1,507,827 tons

Parts Replacement Cost:
$0.0028 per ton

When the actual tonnage figures (as supplied by the Chief Engineers of power plants and the Preparation Engineers of coal mines) are compared with the total cost of replacement parts ordered, the real story of the quality and efficiency of American "WC" Coal Crushers is apparent—the story given in the panel above.

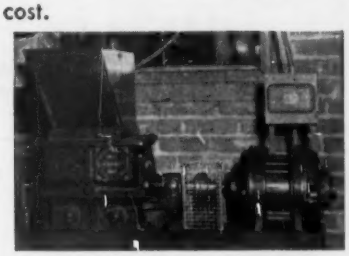
With American, quality is not a mere claim, nor even an isolated performance story. It is based on the consistent pattern of high-tonnage-at-low-maintenance for *all types* of American coal crushers—a record directly traceable to the efficient crushing action of the American-originated rolling-ring crushing principle, plus a half century of specialized experience in building coal crushers.

American "WC's" are designed for capacities up to 90 tons per hour . . . but whether your requirements range from coal sampling up to 600 tons or more per hour, American has the crusher to handle your job at the lowest possible cost.

WRITE FOR COMPLETE INFORMATION AND LITERATURE

. . . and for low-cost coal sample crushing

Model 9-9 American Laboratory Crusher, one of several sizes for reducing coal samples prior to analysis.



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Originators and Manufacturers of Ring Crushers and Pulverizers

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estimate smoke density accurately in seconds with the

NEW M•S•A SMOKESCOPE

This precision built, optically accurate instrument gives you a reliable method of estimating smoke density. The lens projects a standard reference film disc to a focal distance equivalent to that of the smoke. This permits accurate, quick comparison without changing eye focus. Background variations, ambient light are minimized. Sturdy leather carrying case protects Smokescope, aids handling. Fill in coupon for complete details.

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Mine Safety Appliances Company
Please send me complete details on the new M.S.A. Smokescope

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Firm_____
Address_____
City_____ State_____
P

More TECHNICAL BRIEFS

Begins on page 168

power capacity of approximately 3.3-million kw for the initial stage, and 5.1-million kw when completed. About 11.6-million kw of installed capacity will be available in the Columbia Basin at Corps of Engineers projects, when those in the complete authorized program are finished. In general, the load factor of these projects is high and can be increased economically with planned upstream storage. Much is being accomplished with respect to holding costs of these projects to a minimum. *APC paper; no number.*

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from the following sources unless otherwise stated. Order complete paper from source, not POWER.

American Institute of Electrical Engineers. Identified by initials AIEE and obtainable through AIEE, 33 W 39th St, New York 18, New York.

American Power Conference, 16th annual meeting. Identified by initials APC and obtainable through purchase from R A Budenholzer, chairman, Illinois Institute of Technology.

World Power Conference, 4th meeting. Identified by initials WPC and obtainable from Secretary, Brazilian National Committee, WPC, Rua Visconde de Inhauma, 134-15 Pav, Rio de Janeiro, Brazil.

Atomic Industrial Forum. Identified by initials AIF and to be published in AIF "Proceedings" through AIF, 260 Madison Ave, New York 16, New York. Price $5.00.

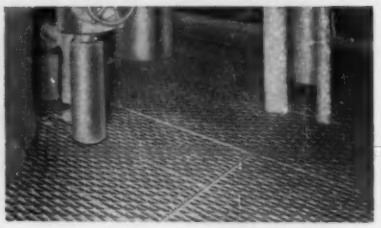
Association of Iron and Steel Engineers. Identified by initials AISE and to be published in their entirety by AISE, Empire Building, Pittsburgh, Pennsylvania.

Membership in the American Institute of Electrical Engineers has reached an all time high of 48,515, with an additional 3371 student members. There are 105 Sections in the U.S., Canada and Mexico.

Ohio Power Co has placed the second of two 200,000 kw generating units in commercial operation at its new Muskingum River Plant, near Beverly, Ohio. This is the fourth unit of this size added to the American Gas and Electric Co System, of which Ohio Power is a part, in the past 11 months. It raises total System capacity to 3,831,000 kw.

SPECIFY ...IRVING!

Safe Floors Start with IRVING GRATING



• non-skid surface • fireproof • versatile
• economical • strong • durable
• practically maintenance-free
• self-draining • self-ventilating

BE RIGHT
WHERE IT COUNTS!

INSIDE

Flooring • Walkways • Catwalks • Balconies • Stair Treads • Fitted to specifications around Turbines, Machines, Pipes, Pillars, and other irregular shapes.

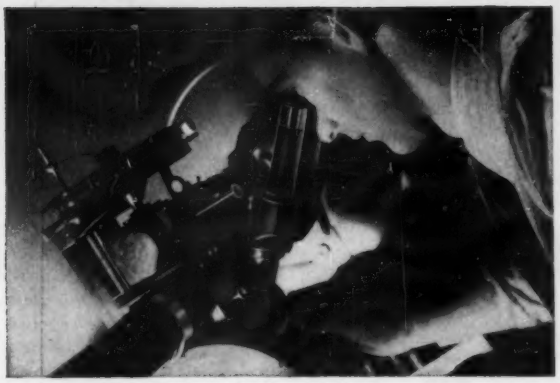
OUTSIDE

Draingrates • Stairways • Catwalks • Fire Escapes • Platforms • Runways

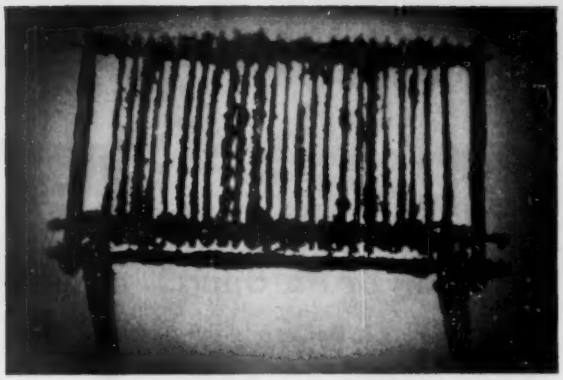
Pioneer Manufacturers of Riveted, Pressure-Locked and Welded Gratings

IRVING SUBWAY GRATING CO., INC.
ESTABLISHED 1902

OFFICES and PLANTS at
5088 27th St., Long Island City 1, N.Y.
1888 10th St., Oakland 20, California



LABORATORY TESTING—The modern Chase laboratories provide an excellent testing ground for condenser tubes under conditions met in many varied industries.



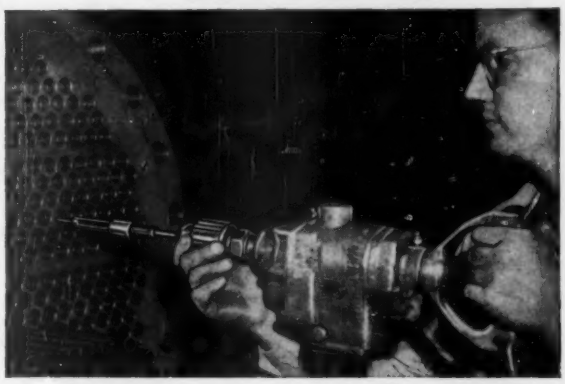
FIELD TESTING—This rack of test specimens was in a heat exchanger. These field tests help Chase perfect the alloy best suited for *your* job.

How to be *SURE* about CONDENSER TUBES

Take Chase Antimonial Admiralty or Cupro-Nickel Tubes, for instance. You *know* they'll give you years of service. They're manufactured under carefully controlled conditions. They're tested for every stress, strain and attack. They're inspected again and again. When a Chase condenser tube goes into service we're *sure* it will stand up. You can be sure, too.

Prompt Shipments from Mills in Cleveland and Waterbury

CARE IN MANUFACTURE—During every step of the way from casting to packing, Chase tubes are carefully supervised and continually tested.



YEARS OF ACTUAL USE—Chase condenser tubes and heat exchanger tubes save industry thousands of dollars annually . . . because they last longer.

Chase®

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The Nation's Headquarters for Brass & Copper (†sales office only)

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the Brickwork in Boiler and Furnace Linings, Settings, Floors, Doors, Arches, Baffles, Blocks, Special Shapes; for Troweling Inside Duct Lining, etc., for Coke Oven Repairs.

Super #3000 "That Wonder Cement"

SETS HARDER

BONDS STRONGER

LASTS LONGER

You, too, can discover — as have many public utilities and industrial plants — how this amazing air-setting bonding cement definitely cuts maintenance troubles and frequent repairs, especially where service is severe. Make your own test — try Super #3000. You'll wish you had — much sooner.

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- Matchless for Resistance to Flame Erosion and to Abrasion
- Withstands both High and Low Temperatures BETTER
- Adhesive — Durable
- Reduces Spalling

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More POWER NEWS

Begins on page 166

trode material, nor any slag-covering on the weld. Mild steel, with or without normal mill scale, of thicknesses of 1/16 inch and up can be fillet, lap or butt welded. Most significant advance, according to Delaney, was made in the consumable electrode wire that uses a mild steel coated with materials to stabilize the arc.

The system is claimed to use one-third less shielding gas than similar welding processes now on the market, resulting in 25% less cost per inch of metal deposited over manual methods.

Million dollar aluminum mill of Anaconda nears completion

► EXPANSION at Anaconda Wire and Cable Company's Great Falls, Montana works will add facilities for automatic rolling of aluminum rods. A million-dollar aluminum mill, to be housed in a new fabricating plant, is being readied for operation early next year.

In addition to the rod rolling mill, wire drawing and stranding equipment valued at another million dollars will be used for production of high quality bare aluminum and strand.

Anaconda has been producing aluminum wires and cables at Great Falls for more than two years. Present expansion is expected to keep pace with requirements for these products widely used by public and private industry, particularly electrical utilities.

Privately financed nuclear reactor slated for MIT

► PLANS FOR A PRIVATELY financed nuclear reactor to be used in non-secret research in peacetime applications of atomic power and for educational purposes, have been announced by Dr James R Killian Jr, Massachusetts Institute of Technology president. The reactor and its associated laboratory is expected to cost about $1 million.

Kaighin & Hughes, Inc forms industrial wastes division

► INCREASING PROBLEMS caused by disposition and treatment of waste materials by industry have prompted Kaighin & Hughes, Inc, Toledo, Ohio piping and mechanical contractors, to organize an industrial wastes division with Edmund B Besselievre as its manager.

Lloyd I Hughes, president of the company, states that with organization of the new division all services, including design, engineering and contracting to solve waste materials problems can be accomplished.

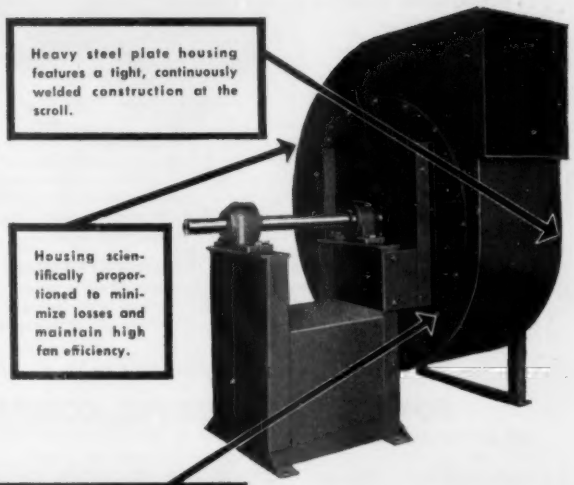
Mr Besselievre is a recognized authority on treatment of industrial wastes and

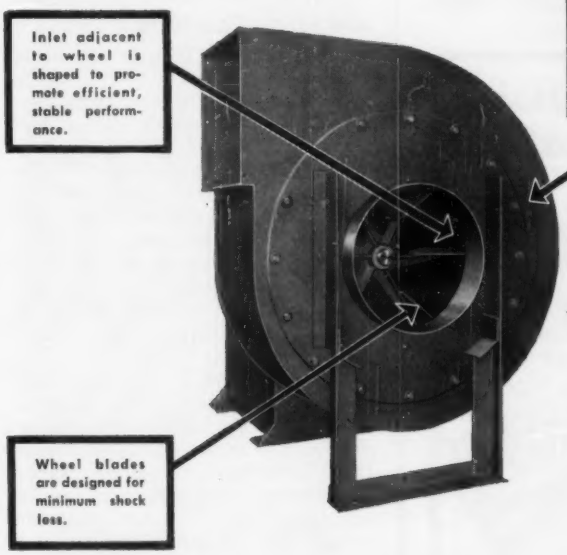
Announcing

the new Clarage TYPE XL Industrial Fans

Exceptional Fan Equipment distinguished by:

1. High efficiency characteristic.
2. Rugged, tight construction.
3. Three interchangeable wheels — each with radial blades.
4. Large size range — 11″ through 60″ inlet diameters.
5. Pressures to 18″ SP; volumes to 130,000 CFM.


Heavy steel plate housing features a tight, continuously welded construction at the scroll.
Housing scientifically proportioned to minimize losses and maintain high fan efficiency.
Adjustable to any of eight standard discharges by merely removing tap bolts on each side and rotating the housing between the sideplates.


Inlet adjacent to wheel is shaped to promote efficient, stable performance.
Wheel blades are designed for minimum shock loss.

Type XL fans shown here are typical of the smaller sizes which provide universal discharge. Larger sizes are of reinforced sheet steel and base angle construction extending to the foundation line.

Send for Bulletin 702

A new, modern design offering many distinct advantages!

Clarage Type XL industrial fans are particularly well suited for diversified air and material handling applications. You'll profit from the high efficiency, in-the-field adaptability, and numerous other features of this exceptional fan equipment.

Learn more about these distinguishing features by requesting Bulletin 702, or contacting the nearest Clarage application engineering office.

CLARAGE FAN CO., Kalamazoo, Mich.

You can Rely on...

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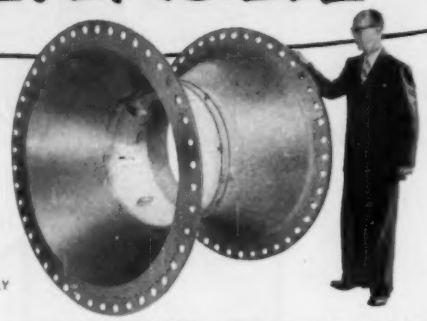
Headquarters for Air Handling and Conditioning Equipment

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA Canada Fans, Ltd., 4285 Richelieu St. Montreal

it's REVERSIBLE

The *Gentile** **FLOW TUBE** measures flow in either direction

*GEN-TIL-LY



REVERSIBLE . . . The Flow Tube is symmetrical, with upstream and downstream ports identical. When the flow is reversed, the differential is reversed. Permits metering reverse flow at lowest possible equipment cost.

LOW INSTALLED COST . . . Average length is only 1½ times the pipe diameter, and straight runs entering and following are not required unless installed near throttling valves or regulators.

ACCURACY . . . Produces differential from points of equal cross-sectional area . . . furnished with head capacity curves, and guaranteed for exceptional accuracy when used with any standard indicating, recording or integrating meter

LOWEST HEAD LOSS . . The Flow Tube can be designed to produce a measurable differential with the lowest permanent pressure loss of any type head meter.

Write for Bulletin FT-101, or for specific recommendations

75 YEARS OF EXPERIENCE

FOSTER ENGINEERING COMPANY

835 LEHIGH AVENUE UNION, N. J.

AUTOMATIC VALVES • SAFETY VALVES • FLOW TUBES

ALLPAX GASKET CUTTERS ...for Bolt Holes and Gaskets

Why take chances with costly maintenance

With this tool you are prepared for any emergency where gaskets are involved. You don't have to have a big stock of miscellaneous size gaskets because with the ALLPAX GASKET CUTTER you cut what you require immediately as you need them . . . in the size and of the material the job calls for. In other words your gaskets are "custom made" . . . cut faster than you could get them out of your stock of maintenance materials.

Capacity: Bolt holes from ¼" to gaskets up to 48" diameter. Cuts any gasket material up to ¾" thick. Investigate NOW!

ALSO: Packings for all purposes, valve discs, sheet packing, moulded and mandrel-cut packing rings, packing hooks, packing in coil, ring or loose form; special packing for special needs.

Contact your nearest distributor or us direct for your requirements.

THE ALLPAX COMPANY INC.

805 Mamaroneck Ave., Mamaroneck, N.Y.

Superheat Sheet Packing . . . Oil Proof Sheet Packing . . . Red Rubber Sheet Packing . . . Diaphragm Sheet Packing . . . Cloth Inserted Sheet Packing

More POWER NEWS

Begins on page 166

has handled sanitary engineering projects in 63 countries over a period of 30 years. Author of the McGraw-Hill book, "Industrial Waste Treatment," published in 1952, he has written more than 75 technical articles on that subject and allied phases of sanitary engineering.

American Nuclear Society holds organizational meeting

► A REPRESENTATIVE group of the 13,000 scientists and engineers engaged in full-time governmental, industrial and educational aspects of atomic energy activity in the United States met recently in Washington to organize the American Nuclear Society.

This is the world's first professional society of scientists and engineers representative of all scientific disciplines engaged in research, development and application of nuclear technology. Principal purpose of the group is to foster the interchange of information and ideas in all fields of research utilizing nuclear techniques.

The society will hold its first technical conference June 27-29 at Pennsylvania State University, State College, Pa.

Water softener check-up service offered by Elgin-Refinite

► ELGIN-REFINITE, Division of Elgin Softener Corporation, Elgin, Illinois is offering a water softener check-up service, without obligation, to improve operation of existing equipment.

Any zeolite water softener will be checked by a field engineer who will submit his findings to the owner in a SECA report (Softener Efficiency Cost Analysis). This report will show in exact figures and percentages what kind of a job the equipment is doing and point out what to do in case of inefficient operation.

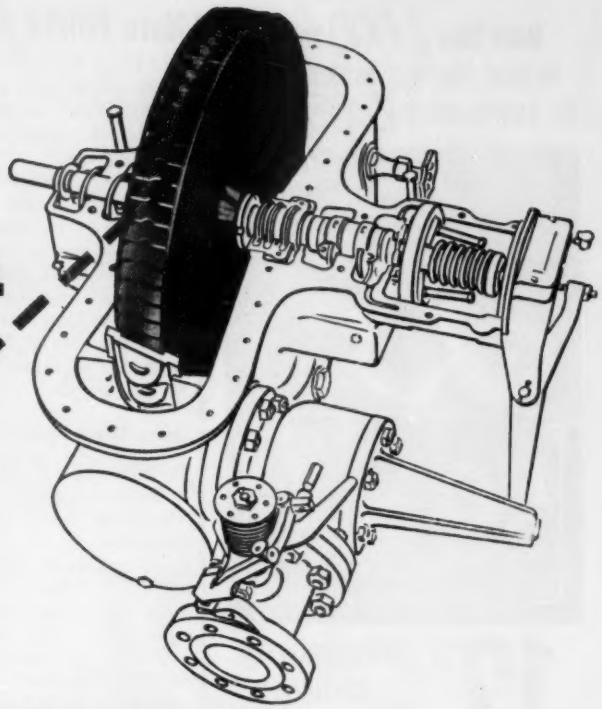
This service was prompted by a survey that showed far too many water softeners in use today are operating considerably below normal efficiency. It was found that operators are generally not aware that simple steps can be taken to increase soft water output, cut regeneration and salt cost, protect and prolong equipment life and bring about other operational improvements.

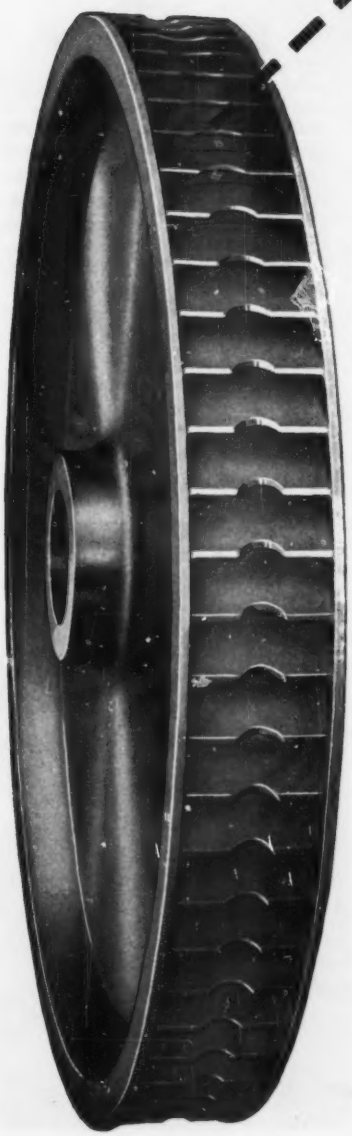
For details of this service request SECA report 50694 from the company.

Giant boiler to produce 1,720,000 lbs steam per hour

► A 193-TON STEAM DRUM, built by the Babcock & Wilcox Co, will become part of the largest single boiler ever built. The giant boiler will reach 15 stories in height, when erected, and supply

TERRY SOLID WHEEL





..."trade mark" of a trouble-free turbine

This is the rotor of a Terry solid-wheel turbine. There are a number of reasons why it has become a symbol for reliable, trouble-free operation.

First, because the wheel is a single forging, in which a series of semi-circular buckets is milled, there are no separate parts to become loose or work out.

Second, because the power-producing action of the steam takes place on the curved surfaces at the back of the buckets, blade wear is of little consequence. Wear does not materially affect horsepower or efficiency.

Third, because the steam enters the buckets in a direction at right angles to the shaft, there is no need for close axial blade clearances. The blades cannot foul. There is a one inch clearance on either side of the wheel. In addition, the blades are double rim protected.

These are only a few of the reasons why the Terry solid wheel has become a "Trade Mark" for trouble-free turbine performance. For complete details, send for a copy of bulletin S-116. No cost or obligation.

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TERRY

TT-1197

More than 2,000 answers to your heating, ventilating and air conditioning PROBLEMS

12TH INTERNATIONAL HEATING & VENTILATING EXPOSITION

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COMMERCIAL MUSEUM
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JANUARY 24-28, 1955

That's what you'll find at the 12th Air Conditioning Exposition when over 400 leading manufacturers in these fast-growing fields will demonstrate over 2,000 new and improved products. There'll be answers to your technical problems on installation and use of conditioning systems in all types of structures. See the latest developments in equipment, practices and materials on display in this 5-day concentrated effort to provide you with the best ideas for economical and efficient modernization.

PLAN NOW TO ATTEND

Look for your answers from exhibits, demonstrations, technically qualified personnel, comparisons of competitive products, on-the-spot cost estimates, available technical data and in other time-saving, cost-saving ways.

Bring your associates to this source of quick and complete information.

Under the auspices of the American Society of Heating & Ventilating Engineers

Management: International Exposition Co.

More POWER NEWS

Begins on page 166

steam for the first of two turbine generating units to be installed at the River Rouge power plant of The Detroit Edison Company.

The boiler will consume more than 400,000 tons of coal each year, but will have greatly increased efficiency. It will produce a maximum of 1,720,000 lbs of steam per hour and deliver it to the turbine at 2000 psi.

Each turbine unit will have a maximum capacity of 273,000 kw, enough electricity to supply the needs of over 700,000 people.

Dean Bros tests every pump, records typical performance

► PRIOR TO SHIPMENT, Dean Bros submits every centrifugal pump to test conditions closely resembling actual conditions under which the pump will operate. Performance data recorded gives full information for typical head capacity curve for later reference.

Testing facilities at the company's modern pump test and research laboratory consist of a closed system in which water is circulated by the pump under study. Water flows from a pressure-tight surge tank to the pump suction inlet at any of four pumping stations. Suction pressure is measured by a mercury manometer; pump discharge pressure by calibrated bourdon tube gauges. Flow rate is controlled by a throttle valve on the discharge side of pump.

Water passes through any of four calibrated venturi meters selected for the flow range required. Each venturi is permanently connected to a mercury manometer indicating flow rate directly in gallons per minute. Power required for pump operation is measured by using cradle mounted motors as dynamometers. Accurate efficiency values are thus obtained.

Use of a closed system affords accurate control of pump operation closely approximating actual conditions of service. Duplication of NPSH conditions required in the field can be easily demonstrated in the laboratory.

Fire tests show 85% magnesia insulation stands 2000 F flame

► FIRE TESTS CARRIED out with 85% magnesia thermal insulation demonstrate that the material will withstand a 2000 F flame for an extended period without appreciable damage, it is said. Tests conducted by the technical committee of The Magnesia Insulation Manufacturers Association indicate that the insulation is capable of protecting pipes and equipment and their contents under average fire conditions.

Insulation applied to a section of steel

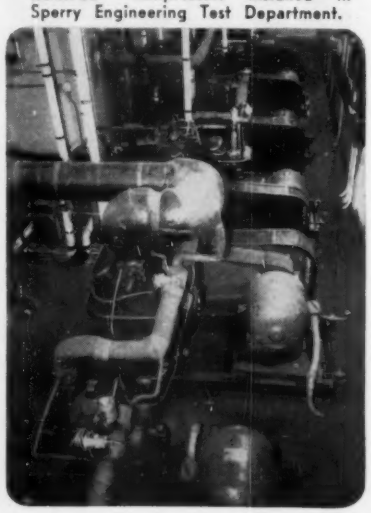
Sperry Gyroscope Co. Operates 12 Test Boxes with FRICK Refrigeration

At the Great Neck, Long Island, plant of Sperry Co., a dozen environmental test chambers have been equipped with cooling and humidity control, operated by an elaborate low-temperature refrigerating system. This was designed and installed by Tenney Engineering, Inc., Union, N. J., using 14 Frick "ECLIPSE" compressors. Temperatures range from 100° below zero to 200° above.

Whatever your special cooling needs, there's a Frick air conditioning or refrigerating system to meet them with dependability. Let us submit an estimate: write, wire or phone—

DEPENDABLE REFRIGERATION SINCE 1883
FRICK CO.
WAYNESBORO, PENNA. U.S.A.

Below: Six of the fourteen Frick "ECLIPSE" compressors installed in Sperry Engineering Test Department.



"Here's where we can't go wrong," I told John

John is my partner in a small manufacturing enterprise we started six years ago. Recently we decided to build a new plant that would give us added space and the most modern facilities. There were a lot of hard decisions to make because we just haven't enough money to afford mistakes, even little ones.

Then came the question of what fuel to use. The answer to this one was so easy, it was almost a relief. Coal—for these reasons:

The cost of quality coal to meet our most exacting requirements should be substantially less than that of any other fuel.

With modern stoker and coal and ash handling equipment, our steam costs should be reduced to a minimum.

Not only can we store as much reserve coal as we require in our own yard safely and inexpensively, but there's no worry about curtailment in delivery and diminishing supply, as could be the case with other fuels.

We figured, too, that if companies many times our size are burning coal – and for the same reasons – we can't go wrong.

COAL
FUEL OF THE FUTURE

Chesapeake and Ohio Railway

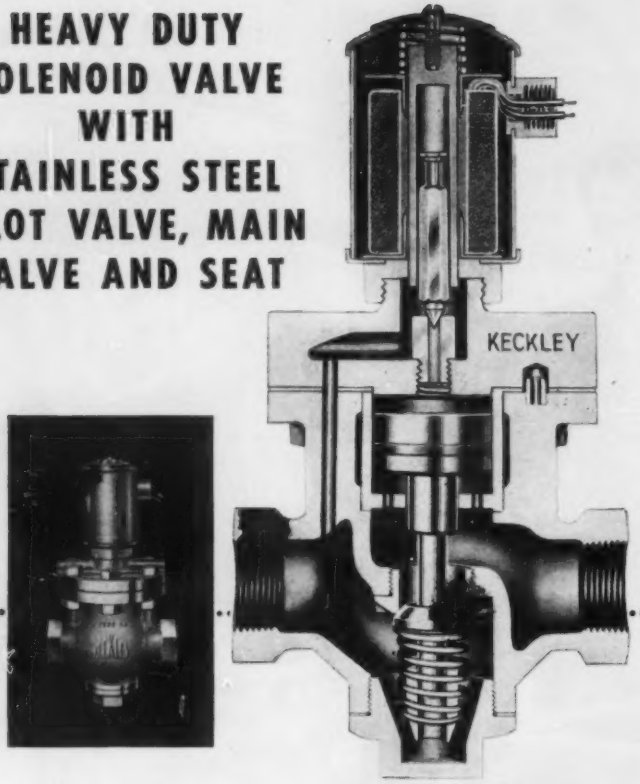
World's Largest Carrier of Bituminous Coal

Bring your fuel problems to C &O

As the world's largest carrier of bituminous coal, the C&O is intimately familiar with every phase of coal use. We have a large staff of experts who will gladly help you to locate the coal best suited to your needs; to help you use it most efficiently; to help get it to you promptly.

Write to:
Coal Traffic Department
Chesapeake and Ohio Railway
2115 Terminal Tower
Cleveland 1, Ohio

HEAVY DUTY SOLENOID VALVE WITH STAINLESS STEEL PILOT VALVE, MAIN VALVE AND SEAT



• The heavy duty pilot operated Type EA Keckley Solenoid Valve has many features not found in all solenoid valves. Simplicity of design has eliminated many wearing parts, and parts subject to wear are renewable. The piston is located above the flow eliminating any possibility of sediment scoring the cylinder liner. Valve body assembly is the same as Keckley Pressure Regulators of equal size—parts are interchangeable.

Incorporated into these valves are the best of materials and workmanship.

Order one for a test in your plant—no obligation. Write for details—Catalog 54-C.

SPECIFICATIONS

TYPE EA SOLENOID VALVES

Maximum Steam Pressure—250 lbs.
Maximum Air, Water, Oil and Gas Pressure—600 lbs.
Sizes ½" to 6" with Bronze or Semi-steel Bodies
Pilot Valve, Main Valve and Seat—Stainless Steel
Cylinder Wall—Bronze or Monel
Coils—Heavy Duty, Glass Insulated, Moisture Proof

O. C. KECKLEY COMPANY
400 W. MADISON ST.
CHICAGO 6, ILLINOIS

Pressure Regulators • Temperature Regulators • Float Valves
Strainers • Solenoid Valves • Reducing Valves
Pop Safety Valves • Relief Valves

KECKLEY CHICAGO

More POWER NEWS

Begins on page 166

pipe by standard methods showed no damage beyond slight surface cracks after two hours in the intensely hot flame. Temperature on the surface of insulated test pipe was below 600 F. Results indicate that 85% magnesia would remain intact and would protect pipe lines, flues, ducts and other equipment from fire damage. During a plant fire it would also prevent sudden temperature rise of the contents of pipes and vessels, it is claimed.

Tests also showed that the insulation resists fire damage equally well when convered with canvas, galvanized steel, aluminum or various asphaltic jackets. However, the type of jacket did not have any marked effect on the amount of heat transmitted through the insulation to the pipe surface, although somewhat lower temperatures were recorded for the canvas-covered samples.

As a basis for comparison, six other types of thermal insulation were tested under identical conditions. Results, the association's technical committee said, showed that canvas-covered 85% magnesia showed superior resistance to hot flame. While jacketing other than canvas improved performance of other types of insulation, it was claimed that 85% magnesia performed about equally well under all conditions.

Atomic battery uses heat from radioactivity for energy

► SCIENTISTS at Mound Laboratory, Miamisburg, Ohio, have developed an atomic battery that uses heat from radioactivity to produce electrical energy. Mound Laboratory is operated by Monsant Chemical Company for the Atomic Energy Commission. The battery makes use of a thermopile (a series of thermocouples) that converts the heat from radioactive decay into electricity. It has electrical energy comparable to ordinary dry cells.

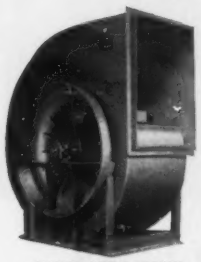
One hundred fifty curies of the element polonium is sealed in a small capsule. Surface of the capsule is in contact with hot junctions of 40 thermocouples. The capsule is thermally insulated with a silica aerogel and positioned within a surrounding container. The cold thermocouple junctions are on the surface of this container. A temperature difference of about 450 F is thus maintained between the capsule and the actual container (or between hot and cold junctions).

Polonium is used because it is essentially a pure alpha particle-emitting material. This element emits an alpha particle of 5.298 mev energy with a 138 day half-life.

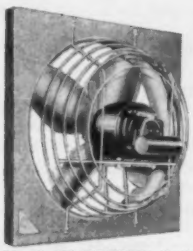
The battery is believed to have capabilities for use in instruments and

BEST GIFT for your PLANT

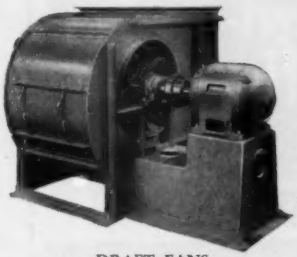
DEPENDABLE "BUFFALO" FANS with the FAMOUS "Q" Factor*



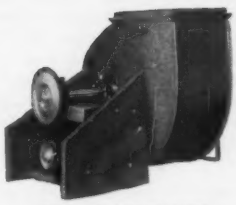
TYPE "BL" FANS
In sizes for 1,000 to 500,000 cfm, these new non-overloading fans for general ventilation and air conditioning offer even finer performance than their famous predecessors, the "LL" Fans.
NEW BULLETIN F-100



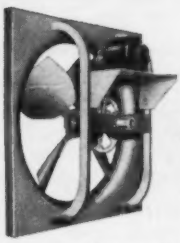
New! NV-BREEZO FANS
Their specially-shaped four-blade wheel gives high efficiency even against system pressures of ¼" and ½". 8" to 24" sizes.
BULLETIN 3865



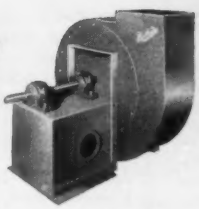
DRAFT FANS
"Buffalo" mechanical Draft Fans are helping turn out low-cost steam in plants and major utility stations everywhere.
BULLETIN 3750



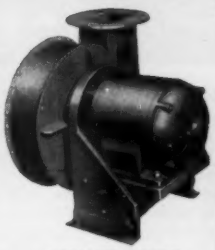
BELTED VENT SETS
Non-overloading ventilating fans for duct or free air delivery. Extra quiet.
BULLETIN 3720



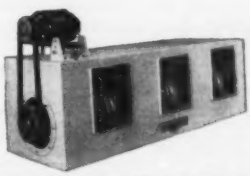
New! BELT-AIR FANS
Quiet, sturdy fans to move a lot of air at negligible cost. Heavy-gauge die-stamped blades and panel.
WRITE FOR DETAILS



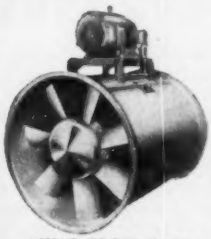
INDUSTRIAL EXHAUSTERS
All-welded for strength and high efficiency. With air or material wheels.
BULLETIN 3576



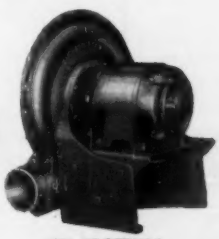
"CB" PRESSURE BLOWERS
Up to 2¼ psi, single stage with these husky, space-saving units!
BULLETIN 3553



SHORTBOY VENTILATING SETS
Quiet, efficient, vibration-free fans. Wheels mounted on hollow shaft.
BULLETIN 3701



AXIAL FLOW FANS
Compact, light, highly efficient ventilating fans for light duty.
BULLETIN 3533



"E" BLOWERS-EXHAUSTERS
For low to medium pressures and volumes in draft, cleaning, line boosting.
BULLETIN 3014

VOLUME FANS
Rugged blowers-exhausters with cast iron housings and dust-proof ball bearings for any job up to 10" s.p.
BULLETIN 3615

"Buffalo"

*The "Q" Factor — *The built-in Quality which provides trouble-free satisfaction and long life.*

BUFFALO FORGE COMPANY
488 BROADWAY BUFFALO, NEW YORK
PUBLISHERS OF "FAN ENGINEERING" HANDBOOK
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

FORCED DRAFT, PRESSURE BLOWING, HEATING, COOLING, VENTILATING, AIR CLEANING, AIR TEMPERING, INDUCED DRAFT, EXHAUSTING

JUDGE FOR YOURSELF!

Is a Versatile

COAGULANT!

Because It Has These Superior Advantages:

1 Rapid Floc Formation	6 Ease of operation
2 PH correction	7 Bacterial removal
3 Taste and odor control	8 Manganese and Silical removal
4 Color removal	9 Turbidity removal
5 Softening	10 Economy

From these advantages you can see why so many users of Ferri-Floc consider it a superior coagulant. Whatever your specific water treatment problem may be, you can figure on Ferri-Floc to do the job adequately and efficiently. A partially hydrated ferric sulphate, Ferri-Floc is a stable, free-flowing, granular salt which can be fed with few modifications through any standard dry feed equipment. It is only mildly hygroscopic, thereby permitting easy and safe handling as well as storage in closed hoppers over long periods of time.

Water Treatment

Coagulation of surface or well waters. Aids taste and odor control. Effective in lime soda-ash softening. Adaptable to treatment of nearly all industrial water or wastes.

Sewage Treatment

Coagulation of wide PH range. Efficient operation regardless of rapid variations of raw sewage. Effective for conditioning the sludge prior to vacuum filtration or drying on sand beds.

SULPHUR-DIOXIDE SO_2 | COPPER SULPHATE TC

SULPHUR-DIOXIDE Is effectively used for dechlorination in water treatment and to remove objectionable odors remaining after purification.

COPPER SULPHATE Will control about 90% of the microorganisms normally encountered in water treatment plants more economically than any other chemical.

Samples, Specifications and Detailed Information on Request.

TENNESSEE TC CORPORATION

617-629 Grant Building, Atlanta, Ga.

More POWER NEWS

Begins on page 166

apparatus where long life, dependability and known output are primary requirements. It would be desirable for applications where weight must be limited and for apparatus subjected to wide variations in temperature.

At this time, large scale manufacture of atomic batteries is not economical. Alpha-emitting radioisotopes are routinely available only in relatively small quantities and their cost is high.

Coming Events

Dec 2-7—21st National Exposition of Power and Mechanical Engineering. Commercial Museum, Philadelphia, Pa. Details from International Exposition Co, 480 Lexington Ave, New York 17, N. Y.

Jan 23-27—Associated Equipment Distributors, 36th annual meeting. Conrad Hilton Hotel, Chicago, Ill. Details from AED, 30 E Cedar St, Chicago 1, Illinois.

Jan 24-27—Plant Maintenance and Engineering Show, sixth exposition. International Amphitheatre, Chicago, Ill. Information from Clapp & Poliak Inc, 341 Madison Ave, New York 17, New York.

Jan 24-28—American Society of Heating and Ventilating Engineers, 61st annual meeting and 12th International Heating and Ventilating Exposition. Commercial Museum and Convention Hall, Philadelphia, Pa. Details from ASHVE, 62 Worth St, New York 13, New York.

Jan 26-28—Instrumentation for the Process Industries, tenth symposium. College Station, Texas. Complete information from School of Engineering, University of Texas, College Station, Texas.

Jan 31-Feb 4—American Institute of Electrical Engineers, winter general meeting. Statler Hotel, New York. Write AIEE, 33 W 39th St, New York 18, N. Y.

Jan 31-Feb 4—American Society for Testing Materials, committee week. Netherland Plaza Hotel, Cincinnati, Ohio. Complete information from ASTM, 1916 Race St, Philadelphia 3, Pennsylvania.

Accident facts, National Safety Council's 96-page statistical yearbook, contains facts and figures on industrial, traffic, home, farm and school accidents.

Twenty pages devoted to occupational accidents give a detailed list of accident rates by major industry groups, as well as charts showing the accident trend during the past 25 years. Topics include most common source of injuries, part of the body most frequently injured, off-the-job accident problems, unsafe acts and unsafe conditions contributing to permanent impairments and deaths.

Price $0.75 a copy. Direct inquiries to the National Safety Council, 425 N Michigan Avenue, Chicago 11, Illinois.

Why I keep 2 spare gauge glasses

For top boiler safety, the experts tell me never to put the same glass into a gauge after I've had it apart.

That's why I always keep *one* spare around. The other one? Well, I like to feel that, if someone should accidentally break a gauge, I've got another one all ready to go into place, without losing any valuable time.

In football, they call it "depth." In boiler maintenance, they call it smart planning. And for the few cents it costs to buy two spares, I get rid of a bothersome replacement problem.

* * *

Why don't *you* give yourself that confidence? Call your industrial distributor and order *two* spares for every boiler in your plant. Of course, you'll want PYREX brand gauge glasses —safest on the market, because of strong, heat-resistant construction. They're easier to read, too, because their chemical stability resists corrosion by steam, keeps glass fog-free longer.

CORNING INDUSTRIAL GLASSWARE FOR EVERY JOB

Application	Recommended Product
Normal Conditions (Up to 100 p.s.i.)	CORNING brand standard gauge glasses
Higher temperatures	PYREX brand high-pressure gauge glasses
Higher pressures	PYREX brand heavy-wall gauge glasses
Extra visibility	PYREX brand red-line gauge glasses
Viewing inside furnaces, reactors pressure vessels, etc.	PYREX brand sight glasses
Lubrication inspection	PYREX brand lubricator glasses
Visible discharge devices	PYREX brand oil cup glasses

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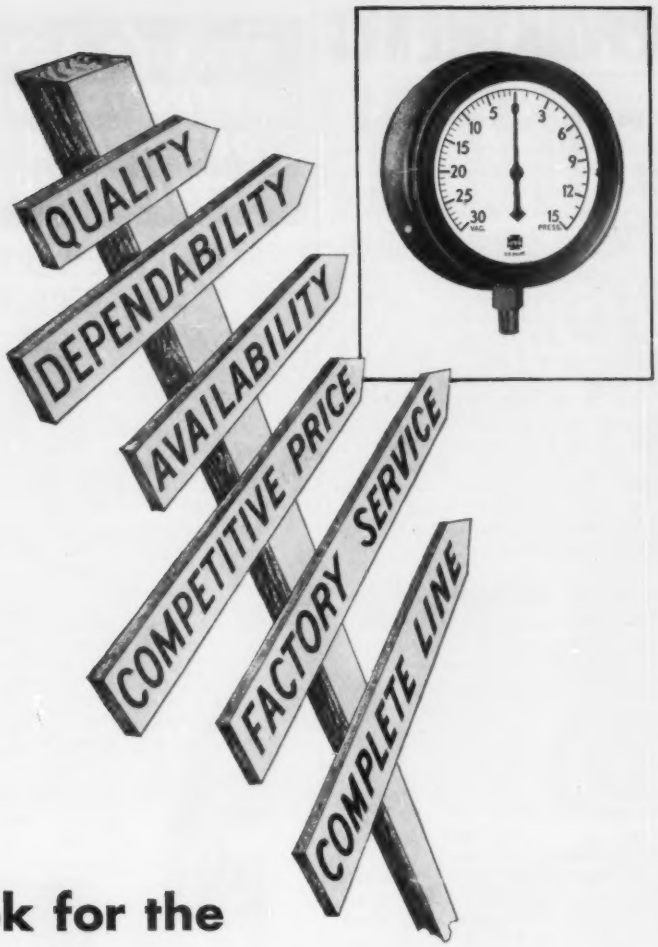
CORNING GLASS WORKS
Corning, New York

Corning means research in Glass



Look for the

USG *Plus Factors*

when buying gauges

Over and above mechanical features—*quality* . . . assurance of sustained high accuracy . . . long, trouble-free service . . . are most important. But, availability and price are also important.

When you buy USG gauges, you're assured guaranteed satisfaction in enduring accuracy, performance, dependability and price. For over 50 years, USG gauges have been renowned for their high accuracy and dependability—more original equipment manufacturers specify USG than any other make.

USG stocks for your convenience over 200,000 standard gauges of all types. See your USG Distributor for all your gauge requirements. More than likely, he can supply you with any quantity of gauges you want for any application, directly from his stock.

UNITED STATES GAUGE

Gauge Headquarters
for over 50 years

United States Gauge, Division of American Machine and Metals, Inc., Sellersville, Penna.

USG'S MODERN RESEARCH LABORATORY HELPS INDUSTRY CUT GAUGE COSTS

Quality, accuracy, immediate availability, price—these are important factors in gauge buying.

Equally important, however, is assurance that gauges will perform with lasting dependability. USG provides that assurance by testing under simulated operating conditions in its Research Laboratory. Annually, these USG tests save customers hundreds of thousands of dollars in superior operating performance and less down time, not to mention eliminating more frequent gauge replacements.

Constant testing of materials under all kinds of operating conditions and pressures is one of the many reasons why USG gauges are renowned for their enduring accuracy and dependability. USG assures this accuracy and dependability in lot after lot by employing in its manufacture the most rigid quality control system in the instrument industry.

Higher quality gauges at competitive prices are made possible by USG because its facilities are economically integrated for large volume quality-controlled production. It provides further savings to industry by stocking the world's largest, most complete line of gauge components to meet practically any pressure sensing and indicating need. From these components USG engineers often make special gauge designs, at practically stock costs, to meet individual operating conditions.

Gauge for gauge—in every application classification—*in every price class*—USG has more to offer than any other make gauge.

Above, a portion of USG's Research Laboratory. Here constant testing of materials under customer operating conditions assures optimum efficiency and long gauge life.

Reach any Overhead Valve From the Floor with...

Babbitt
Adjustable
SPROCKET RIM
with Chain Guide

Get positive, efficient control of any overhead valve right from the floor! No expensive apparatus, no switches, no costly detours to bring overhead piping to floor level — because every valve is within easy reach, when you use low-cost Babbitt Adjustable Sprocket Rim with Chain Guide. Easily assembled and installed, ready to operate in a few minutes.

- Safe, sane & sensible
- Cuts piping costs
- Saves fuel & steam

Range of 10 adjustable sizes fits all valve wheels from 2 to 30 inches diameter, with rising or non-rising stems. Only four simple, quickly-assembled parts.

Call your Industrial Distributor. He carries complete stocks. Or write for descriptive folder and prices.

Babbitt STEAM SPECIALTY CO

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TRI-LOK
safety steps

"A STRONG STEP TO SAFETY"

Each Tri-Lok step consists of a panel of Rectangular, Diagonal, or U-type Tri-Lok flooring in any desired width, length, depth, and bar spacing.

SAFE—checker plate nosing bars make each step stand out clearly. Abrasive edging also available.

CLEAN—Clogless, rivetless Tri-Lok joint prevents accumulation of dirt, moisture, rust.

STRONG—added strength provided at maximum load contact by shape and rigidity of nosing bar.

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DRAVO CORPORATION

National Distributor for the Tri-Lok Company

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Sales Representatives in Principal Cities

DRAVO

APPOINTMENTS

Corporation executive changes

Stearns Magnetic, Inc: R M Miller, vice-president. **Turbine Equipment Co:** Harold Sinclair, chairman of the board; Donald F Miller, president; Paul E. Linthwaite, vice-president in charge of machinery sales. **Borg-Warner Corp:** Frank M Hawley, chairman of the board, Stanley J Roush, president, of Morse Chain Co; J. Rodger Dryden, chairman of the board, T J Ault, president and general manager of Long manufacturing div; John W DeLind Jr, chairman of the board, Rowland Burnstan, president, Borg-Warner International Corp.

Mercast Corp: Ronald D Gumbert, vice-president. **The New York Air Brake Co:** Bernard Peyton, chairman of the board; Charles T Zaoral, president. **Caterpillar Tractor Co:** Charles A Woodley, vice-president. **Western Electric Co:** Timothy E Shea, vice-president.

Operations executive changes

The Kuljian Corp: Harvey F McPhail, head of hydroelectric div. **Worthington Corp:** Walter E Max, superintendent of Buffalo works. **General Electric Co:** William W Kuyper, manufacturing engineering manager of large steam turbine generator dept; F Loomis Lamprey, mechanical engineering manager of construction engineering section. **Minneapolis-Honeywell Regulator Co:** Marshall B Taft, manager of valve div; Stephen A Keller, manager of Heiland div.

U.S. Rubber Co: Edwin D Meade, manager of industrial products sales, mechanical goods div. **Electric Steel Foundry Co:** Jefferson J Davis, vice-president of product div. **Arizona Public Service Co:** Walter T Lucking, vice-president, operations; T A Phillips, vice-president, engineering; George H Groh, vice-president, planning and production. **Westinghouse Electric Corp:** W D Ligon, manager Vicksburg, Miss. plant.

Engineer changes

Westinghouse Electric Corp: W H Brandt, head of new products engineering dept. **Fenwal Inc:** Raymond H Matthews, chief engineer. **The Swartout Co:** Alfred H Mansbach, chief engineer of ventilation div. **Norton Co:** Bruce Cramer, refractories engineer. **Reliance Electric & Engineering Co:** Peterson Nesbit, application engineer, New York office; Albo D Bua, application engineer, Newark, N.J. office.

Solar Aircraft Co: Charles Antoniak, consultant on power plants. **The Ohio Injector Co:** Harry C Bell, director of engineering; A A Kruse Jr, chief engineer. **Caterpillar Tractor Co:** Paul B Benner, chief engineer of Decatur plant.

New sales vice-presidents

Borg-Warner Corp: Ralph W Leigh, Ingersoll steel div; Carl J Meister, Atkins saw div. **Chrysler Corp:** Clyde C Williams, marine and industrial engine div. **Arizona Public Service Co:** Don Willis. **Ameri-**

WORRIED ABOUT WHERE TO PUT YOUR BOILER INSTALLATION?

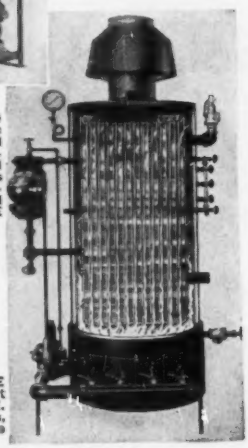
The KANE VERTICAL BOILER PACKAGE IS YOUR ANSWER . .

. . . chances are that floor space is at a premium in your shop or plant . . . if so, you needn't be robbed of this valuable space by a cumbersome, horizontal type boiler . . . not when a KANE *vertical* BOILER PACKAGE will give you the same or probably better results.

The KANE BOILER PACKAGE includes: the correctly sized Automatic Gas-Fired Boiler complete with gas burner and controls to maintain required steam pressure; and an M-K-O Automatic Boiler Feed system designed to return condensate and supply make-up water as required for highest operating efficiency.

"Engineered Steam at its best, with over 50 years of experience at your disposal!"

Full details in new KANE Bulletin, No. 2K.



The M-K-O Automatic Boiler Feed returns condensate and supplies make-up water as needed to the KANE boiler.

The KANE Boiler, built to A.S.M.E. specifications, in sizes to 30 H.P.

INDUSTRIAL GAS EQUIPMENT DIVISION
CODE OF ETHICS SIGNER
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MEARS KANE O'FELDT INC.

DIVISION OF S.T. JOHNSON CO.

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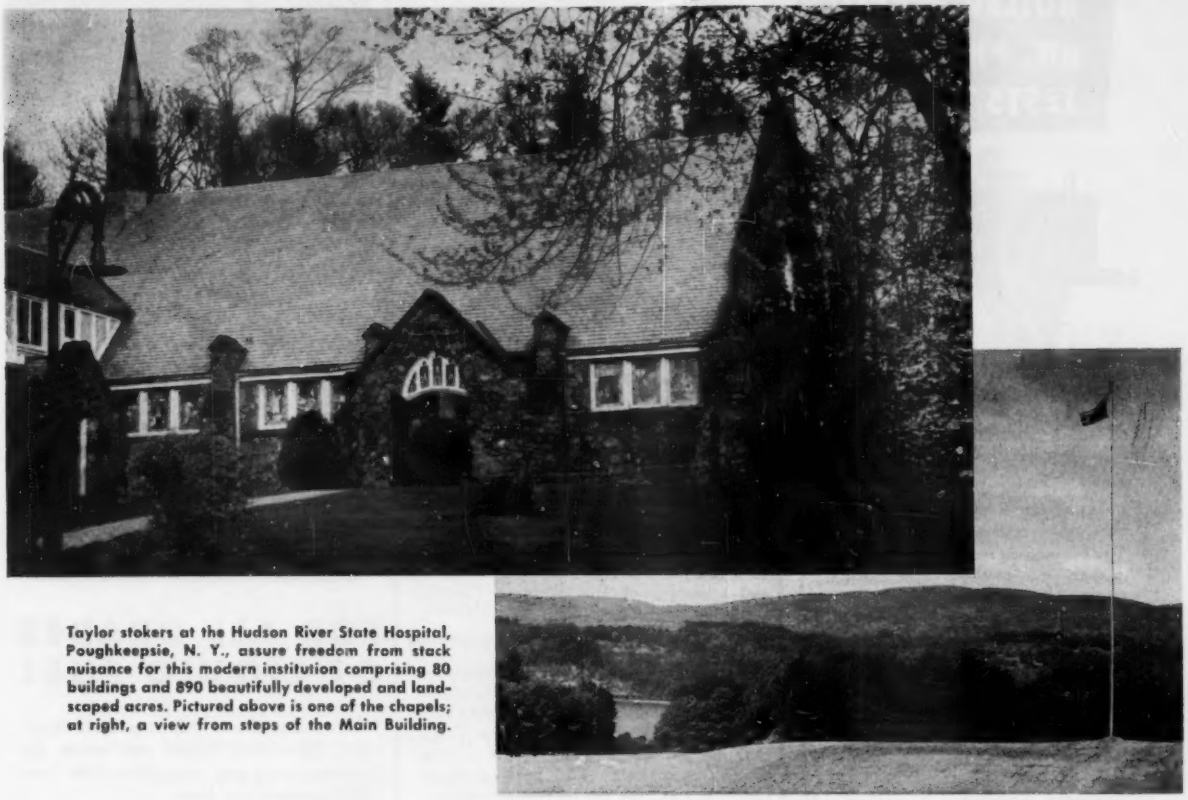
SMOKELESS OPERATION...

TAYLOR, OF COURSE!



Taylor stokers at the Hudson River State Hospital, Poughkeepsie, N. Y., assure freedom from stack nuisance for this modern institution comprising 80 buildings and 890 beautifully developed and landscaped acres. Pictured above is one of the chapels; at right, a view from steps of the Main Building.

Taylor multiple retort underfeed stokers are today's first choice with state institutions, colleges, hospitals, and heating plants in the heart of cities. This is only natural, for properly engineered Taylor Stokers abolish the stack discharge nuisance once and for all—without costly dust collectors and consequent draft losses!

Furthermore, Taylor's smokeless operation is proof of superior combustion and fuel economy. Wet coals and low grade coals are no problem. Refuse is a desirable by-product instead of an added expense. And Taylor can handle widely varying loads with long-continued low steaming rates ...load variations of 20 to 1 or more are common.

The Taylor Stoker is backed by an organization with reliable service stations in Philadelphia, Dayton and Detroit...Whether your new boiler must deliver 20,000 or 500,000 lbs. of steam per hour, ask your Consulting Engineer about Taylor Stokers. And write us for a copy of free booklet giving full information about Taylor, the completely modern stoker with the old, old name. American Engineering Company, 2400 Aramingo Avenue, Philadelphia 25, Pa.

AMERICAN ENGINEERING COMPANY

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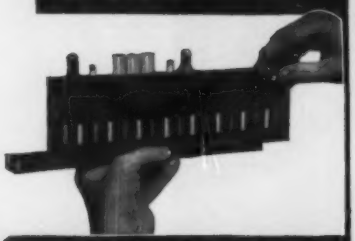
CANADIAN SUBSIDIARIES: AFFILIATED ENGINEERING CORPORATIONS, LTD., MONTREAL 2, P.Q.; BAWDEN INDUSTRIES LTD., TORONTO 3, ONT.

AE Products are: Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists and Car Pullers.

Want the easiest way to make fast, accurate **BOILER WATER pH, PHOSPHATE TESTS?**



TAYLOR COMPARATORS

EASIEST...

because three simple steps give you the determination; every Taylor set is supplied with all necessary reagents and accessories. And, Taylor sets are lightweight, yet strongly built.

FAST...

because many tests can be made in only a few seconds. Others take no longer than a few minutes. Taylor sets are compact, portable so you can make tests on-the-spot, no time wasted carrying samples back to the lab.

ACCURATE...

because all Taylor liquid color standards carry an unlimited guarantee against fading.

All standards for any one determination are housed in a single plastic slide. No single standards to handle. Many different slides can be used on one base.

See Your Dealer Soon!

FREE MANUAL

"Modern pH and Chlorine Control" illustrates and describes full Taylor line. Also gives useful data on theory and application of pH and Chlorine control. Write today.

W. A. TAYLOR AND CO.
YORK RD. & STEVENSON LANE • BALTO. 4, MD.

More APPOINTMENTS

Begins on page 248

can Brake Shoe Co: N George Belury. **The Colson Corp:** Edward C Hamm. **Le Roi Co:** Jack E Heuser. **Electric Steel Foundry Co:** R W de Weese.

New sales managers

H K Porter Co, Inc: Herbert L Waltman, Pacific Northwest district, Leschen wire rope div. **Blackmer Pump Co:** John D Fansler, North Central div; Richard L White, Philadelphia district. **Consolidated Engineering Corp:** Phillip A Wilner, Detroit district of CEC Instruments, Inc.

New distributors

For **Raybestos-Manhattan, Inc,** Manhattan Rubber div: Howell-Lanier Engineering Sales, Baltimore, Md. For **Ampco Metal, Inc:** Industrial Supply Co, Hazleton, Pa. For **Parker Appliance Co:** Persingers, Inc, Charleston, W.Va.

Recent purchases

Westinghouse Electric Corp: all capital stock of Schneider Manufacturing Corp. **Borg-Warner Corp:** through exchange of stock, Weston Hydraulics Ltd will operate as a subsidiary. **The New York Air Brake Co:** all assets of Aurora Pump Co, to operate as Aurora Pump div. **Clark Equipment Co:** acquisition of The Torcon Corp. **Engineered Instruments, Inc:** facilities and operation of D-V Welding Controls.

New companies, names

C C McMillan Industrial Supplies, Portland, Ore, formed to manufacture *Kemaloid,* boiler and cooling water treatment. **Chemax Manufacturing Corp,** New Castle, Del, formed to produce *Tracit* thermal conducting material. **The Johnson-Davis Co,** Chicago, Ill, to represent industrial manufacturers. **Colson Canada Ltd;** subsidiary of The Colson Corp.

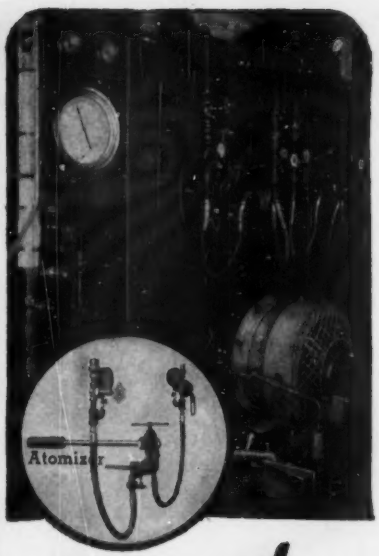
R G White Manufacturing Corp; formerly known as R G White Engineering Co. **Cooper Alloy Corp;** formerly known as Cooper Alloy Foundry Co. **B-I-F Pacific, Inc,** West Coast affiliate of B-I-F Industries, Inc, formerly known as Builders-Pacific, Inc.

Institute elections

Atomic Industrial Forum, Inc: Broderick Haskell and J L Atwood, directors; Earle W Mills, vice-president. **American Society of Civil Engineers:** William Roy Glidden, president; Frank L Weaver and Louis R Howson, vice-presidents. **Instrument Society of America:** Warren H Brand, president; A A Anderson and W H Fortney, vice-presidents.

Obituaries

Richard E Holmes, chief engineer of air conditioning and refrigeration div at Worthington Corp's Holyoke works, October 15. **George C Sears,** 70, retired superintendent of power supply div, Puget Sound Power & Light Co, September 28.



Efficient combustion **with**

Enco Burners

FOR ALL GRADES OF LIQUID FUEL

Enco Burner Units of Steam or Mechanical Atomizing Types are made in various sizes with capacities from 1 to 1000 gallons per hour.

Designed for operation either with or without air registers and for natural or forced draft.

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Capital Spending Plans for 1955 . . .

Here is Good News About Business Prospects

In 1955, American industry is now planning to spend within 5 per cent of the amount it is spending this year on new plant and equipment. This is the tensely awaited result of a check-up just completed by the McGraw-Hill Department of Economics.

Hundreds of companies, by far the largest number in the eight-year history of these McGraw-Hill surveys, cooperated in the check-up. Combined, they represent 29 per cent of all industrial employment and over 60 per cent of employment in the industries where capital investment is highest. Such a broad cross section constitutes a reliable gauge of the plans of industry as a whole.

PLANS FOR CAPITAL INVESTMENT

	MILLIONS OF DOLLARS			Percent Change
	1953 ACTUAL*	1954 ESTIMATED*	1955 PLANNED	1954-1955
All Manufacturing	$10,026	$ 9,249	$ 8,598	—7%
Petroleum Industry†	4,600	4,875	4,920	+1
Mining	506	380	311	—18
Railroads	1,312	851	769	—10
Other Transportation and Communications	2,954	2,922	2,640	—10
Electric and Gas Utilities	4,548	4,274	4,206	—2
ALL INDUSTRY	23,271	21,784	20,727	—5

*United States Department of Commerce; Chase National Bank; McGraw-Hill Department of Economics

†Petroleum refining, included under both "All Manufacturing" and "Petroleum Industry," is included only once in the total

What is the meaning of these plans, detailed by the table below, for capital investment next year? Is it good or bad news, so far as it concerns the prospect of continuing prosperity? It is to this crucial question that this editorial is addressed.

Key to Prosperity

It is not only good but very important business news that American industry plans to spend in 1955 almost as much for new plant and equipment as it is spending this year. The reason it is important is that a high level of activity in the capital goods industries is universally recognized as a particularly potent ingredient of prosperity for the nation as a whole. A dollar spent for capital goods is spent again and again for wages and materials. Its stimulating effects, called by economists multiplying effects, move through the economy in much the same way that a pebble tossed into a pond creates a widening circle of ripples. This is one reason why there is such intense business interest in the surveys of plans for capital investment.

Here are the principal reasons why the results of the McGraw-Hill survey are a good omen for continuing prosperity:

1. American industry is demonstrating that it does not need the stimulus of war-created shortages, or a rearmament boom, in order to maintain a very high level of capital investment.

The slight decrease now planned for 1955 will still maintain a level only about 11 percent below the all-time peak attained in 1953 under the stimulus of a defense expansion boom.

2. Capital investment promises not merely to stabilize at a high level, but actually to increase as 1955 goes on and thus give renewed stimulus to business.

The level of investment now planned for 1955 by *industry* — manufacturing, petroleum, mining, transportation, communications and utilities — is within 5 per cent of 1954. Contract awards for *commercial* construction — stores, office buildings, warehouses and other service establishments — as compiled by the McGraw-Hill publication ENGINEERING NEWS-RECORD, indicate a substantial increase in 1955. Thus total capital expenditures by *all business* may be very close to this year's total.

Actually, in the fourth quarter of 1954, business capital expenditures, as reported to the U. S. Department of Commerce, are down about 2.5 per cent from the average for the year as a whole. So there is a good chance that during 1955 the annual rate of capital investment will rise above this present level.

Effect of Tax Changes

The plans reported by the McGraw-Hill survey are preliminary plans, reported at the beginning of the period of business budgeting for 1955. As budgets are completed, new projects may bring the total expenditure that is planned even closer to this year's figure and thus make an even greater contribution to continuing prosperity.

But it also cannot be too strongly emphasized that these are plans; they are not accomplished investments. As such they have the vulnerability to changed conditions that characterize any plans.

There is some indication in the results of the McGraw-Hill check-up that one change in conditions recently made by the United States government has had an important stimulating effect on plans for business investment next year. It is a liberalization of the allowances for depreciation. Apparently encouraged by this provision, most of the smaller companies are planning to maintain or increase their purchases of new equipment next year, whereas during the past three years their expenditures have been declining. This is obviously a development that strengthens our economy.

A government insensitive to the key importance of capital investment by business, both in providing prosperity and in raising our standard of living, might easily destroy the present plans. One of the easiest and surest means to do this is excessive taxation of business profits which are the key ingredient of business investment. Whether the extraordinarily constructive program recently enacted by the federal government in the field of business taxation can be sustained remains to be seen. **If it can be sustained, the remarkably cheering plans of business for capital investment in 1955 can readily become firm foundations for a continuing prosperity.**

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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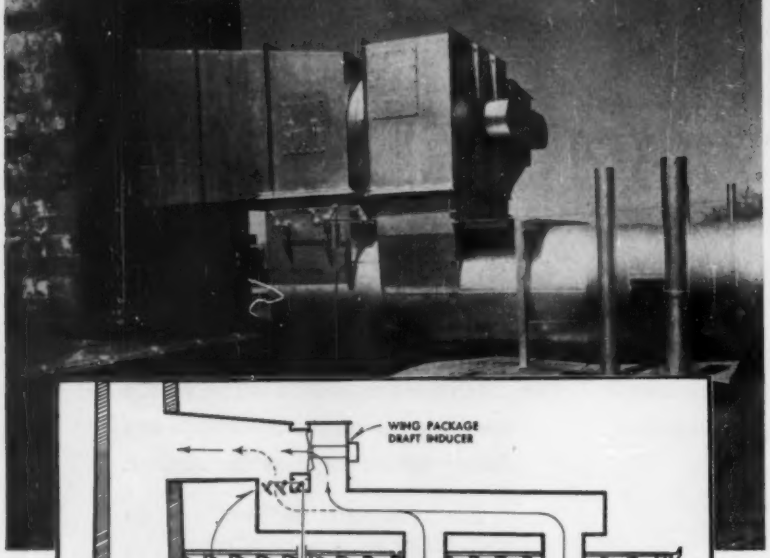

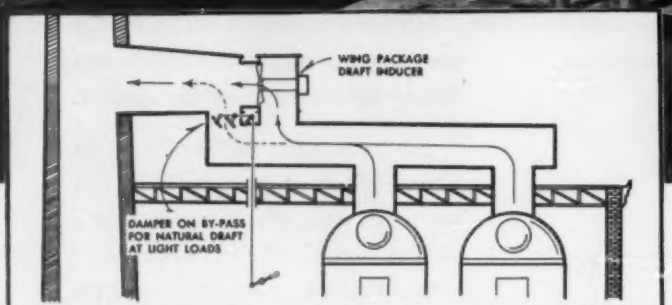

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Electric Transmission and Distribution (*First edition*). *Edited by B G A Skrotzki, associate editor,* POWER; *contributors: E M Adkins, Jersey Central Power & Light Co; F S Benson, Pacific Gas & Electric Co; E L Michelson, Commonwealth Edison Co. 6½x9½, 448 pp, illus, tables, charts, $7.50. McGraw-Hill Book Co, 330 W 42nd St, New York 36, N. Y.*

This is one of four books that make up the ELECTRIC UTILITY LIBRARY. They are written for operators, maintenance men and technical personnel who wish to learn the operating principles of equipment they deal with. While the treatment is elementary it will be of practical help in understanding equipment instruction sheets issued by manufacturers.

This volume starts with a simple introduction to the elements of ac and dc electricity as they apply to generators, transformers and circuits. It then describes equipment used in high-tension electrical transmission, both the terminal bus facilities and cross-country lines, poles and towers. Both overhead and underground lines are discussed as well as submarine cables.

Distribution systems are covered in respect to mechanical requirements, primary and secondary circuits, transformers, capacitors and protection. Here again underground and overhead facilities are described and compared. A short chapter is devoted to various types of street lighting circuits and how they work.

Another chapter describes conditions that a distribution engineer must consider in designing a distribution system. How he puts these factors together in arriving at the best arrangement is given in an elementary manner. The book closes with a chapter on auxiliaries, telling how they are arranged and what jobs they do. Included among this equipment are rectifiers, synchronous condensers, frequency changers, voltage regulators, reactors, converters and capacitors.

Electric System Operation (*First edition*). *Edited by B G A Skrotzki, associate editor,* POWER; *contributors: W C Astley, Philadelphia Electric Co; E L Michelson, Commonwealth Edison Co; E R Paige, Niagara Mohawk Power Corp; M J Steinberg, Consolidated Edison Co of New York, Inc. 6½x9½, 370 pp, illus, tables, charts, $6.50. McGraw-Hill Book Co, 330 W 42nd St, New York 36, N. Y.*

This is another of the four books in the ELECTRIC UTILITY LIBRARY written for operators, maintenance men and technical personnel of public utility systems. The elementary scheme of discussion is carried through this book, even for the rather complicated operations involved.

The three other books of the LIBRARY cover the physical equipment of a utility system. This book tells how this apparatus is run as a unit to deliver energy to a customer. The first chapter covers various types of equipment making up an electric system and how they must be run and maintained. Next chapter turns to important and silent sentinels of the utility sys-

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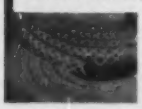

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tem—relays. Here we learn of the many types, their jobs and how they must be coordinated.

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For efficient operation attention must be given to topics covered in the four last chapters: station performance, economy loading, system operating costs, and rate schedules. These are discussed from a brief elementary standpoint that the non-engineer will find easy to follow.

Hydraulics Refresher for Professional Engineers License. *By John Constance, P.E. 11x8½, paper, 84 pp, diagrams, tables, problems. $2.75. Published by author at 625 Hudson Terrace, Cliffside Park, N. J.*

Designed to aid engineers in training and candidates for professional licenses, this refresher is well suited for home study when regular courses are unavailable. It is also useful for operators studying to take examinations for stationary licenses.

Subjects covered include hydrodynamics, circular orifices, sharp-crested weirs, flow of liquids in pipes and channels, and centrifugal pumps.

Illustrative problems throughout each section make the refresher useful for those whose math is a bit rusty. A large number of practice problems permit easy testing of one's grasp of principles and methods.

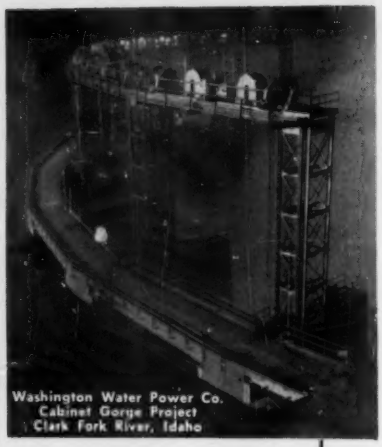
Guidance Procedure for the New York Professional Engineers License. *By John Constance, P.E. 11x8½, paper, 38 pp. $1.00. Published by author at 625 Hudson Terrace, Cliffside Park, N. J.*

These simple step-by-step guides give specific requirements for the professional license in New York State, general procedure for all states, meaning of qualifying experience, how to file application, how to give greatest weight to work experience, philosophy and purpose of written examination, list of accredited engineering schools and colleges, and names and addresses of other State Boards of Examiners.

Both young and older engineers will find the guidance offered in this booklet to be of much value when preparing for the professional license.

The Insulation of Electrical Equipment. *Edited by Willis Jackson in conjunction with 11 authors contributing various sections. 340 pp. 6 x 9. $7.75. John Wiley & Sons, Inc, 440 4th Ave, New York 16, N. Y.*

This book was compiled from lectures delivered at a post-graduate vacation school held in the electrical engineering dept of Imperial College, London, England. The purpose of the school, and hence the aim of this book, is to assist young engineers



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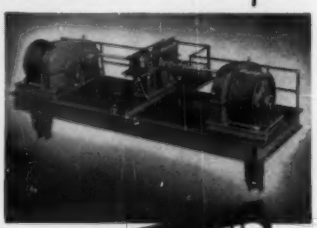

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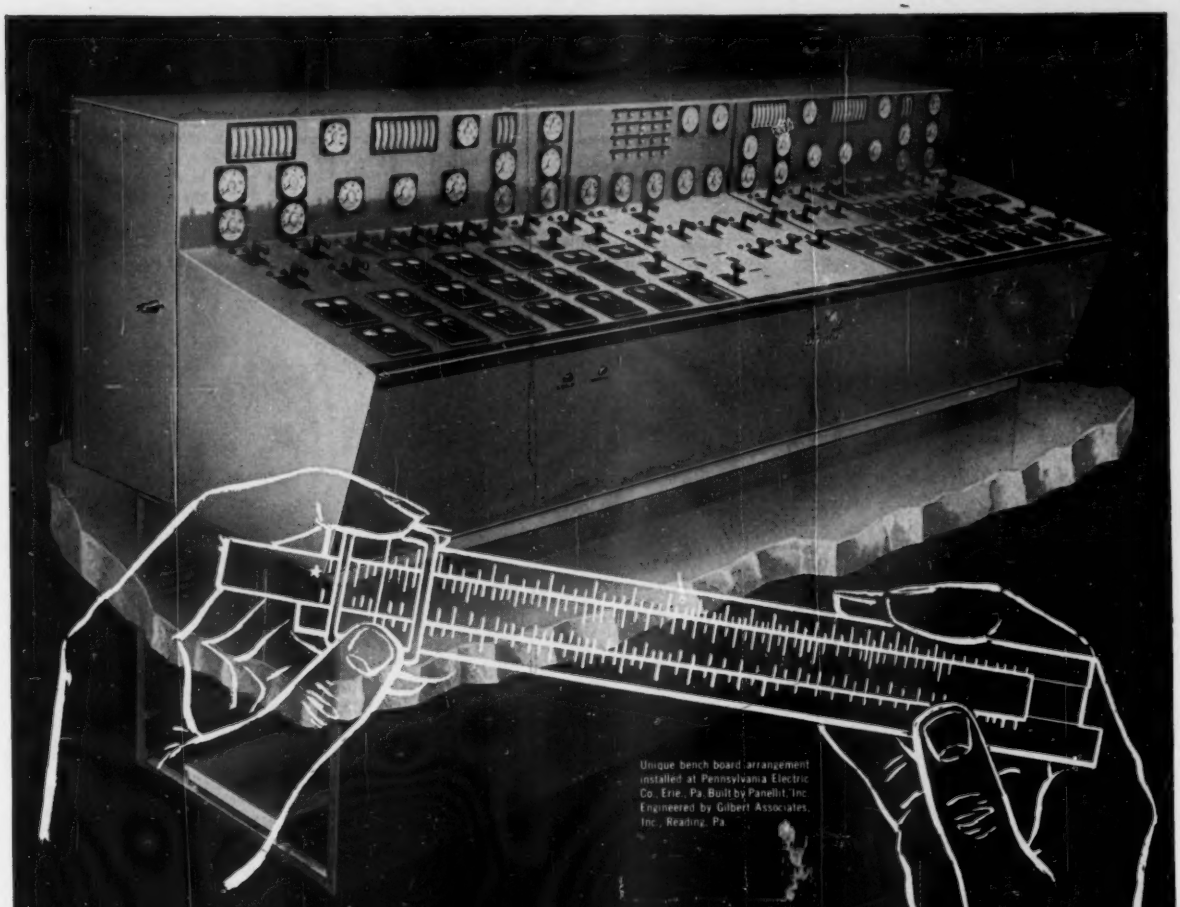

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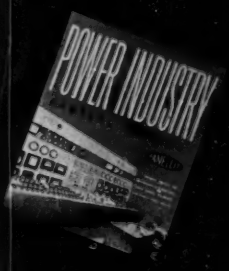

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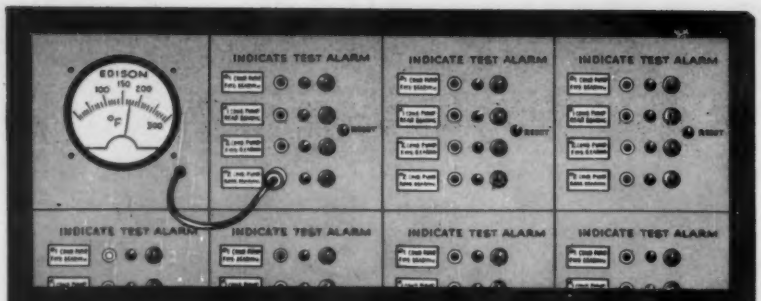

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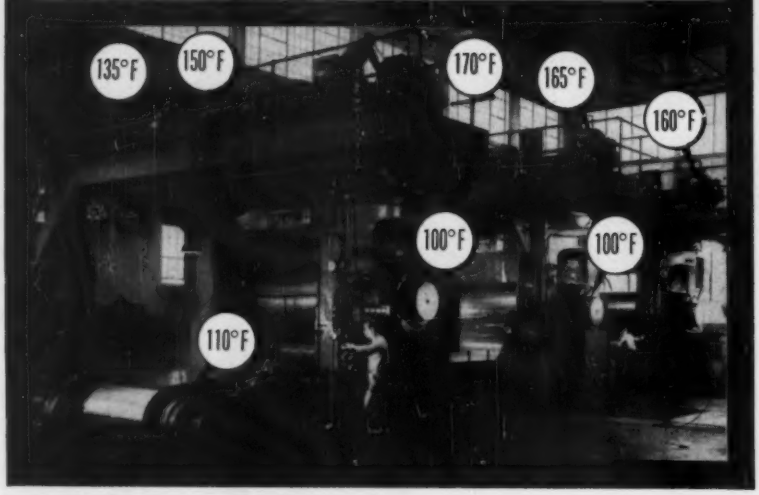

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In the latter class are chapters dealing with permittivity and dielectric loss, dielectric breakdown, classification of insulating materials, communication components, power cables and capacitors, electrical machines, power transformers, switchgear. Finally there is a roundup of today's practices on insulation testing in the laboratory, factory and field. Most of the references made throughout this book are to British publications and papers.

The Atomization of Liquid Fuels (*First edition*). *By E Giffen, professor of civil and mechanical engineering, Queen Mary College, University of London, and A Muraszew. 5½x8½, 246 pp, illus, tables, $6.00. John Wiley & Sons, Inc, 440 4th Ave, New York 16, N. Y.*

This concise survey covers characteristics, properties and most useful reported results of the atomization of liquid fuels. Topics include: disintegration of liquid jets, fuel spray characteristics, effect of atomizer on spray characteristics, simple theory of the swirl atomizer, and use of dimensional analysis for correlation of atomization data. The subject is further developed in respect to effect on spray characteristics of physical properties of liquid and gaseous mediums, formation and development of intermittent and continuous sprays, and experimental methods for assessing fuel spray characteristics.

The Dynamics and Thermodynamics of Compressible Fluid Flow in two volumes (*First edition*). *By A H Shapiro, professor of mechanical engineering, Massachusetts Institute of Technology. 6½x9½, 1185 pp, illus, tables, charts, $16 per vol or $30 for set of two. The Ronald Press Co, 15 E 26th St, New York 10, N. Y.*

Basic objective of the author has been to make this work of practical value for engineering purposes in the fields of high-speed flight, jet engines, rockets, ballistics, combustion, gas turbines, ram jets and similar types of machinery. Problems of this equipment particularly interest aeronautical engineers, mechanical engineers, chemical engineers and applied physicists.

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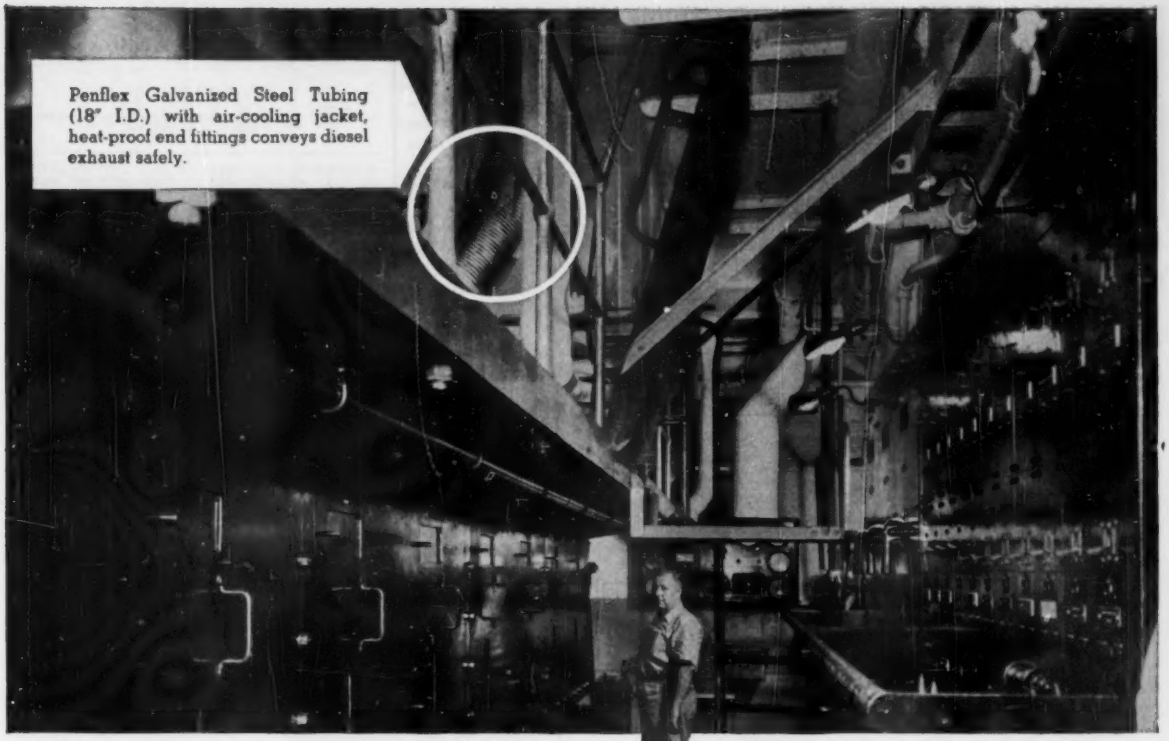

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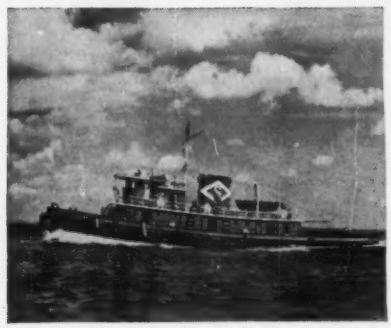

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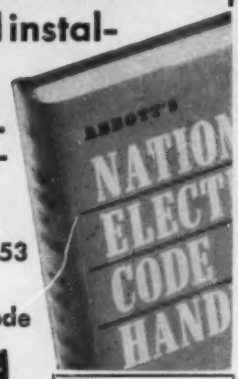

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More BOOKSHELF

Begins on page 252

flow, that is, subsonic and supersonic flow in the same stream. One chapter covers transonic flow and another deals with drag and lift at transonic speeds.

Part VII surveys unsteady motion in one dimension. The three chapters in this part concern unsteady wave motion of small amplitude, one-dimensional continuous flow, and one-dimensional shock waves. Part VIII also contains three chapters dealing with flow of real gases with viscosity and heat conductivity. Chapter headings are: the laminar boundary layer, the turbulent boundary layer and boundary layers in tubes and in the presence of shock waves.

Energy in the Future. *By Palmer C Putnam, consultant to the U.S. Atomic Energy Commission. 6x9, 556 pp, illus, tables, $12.75. D Van Nostrand Co, Inc, 250 4th Ave, New York 3, N. Y.*

In 1949 the Atomic Energy Commission requested Mr Putnam to study the maximum plausible world demands for energy over the next 50 to 100 years. The AEC wanted this information in deciding on a program of developing electrical power from nuclear fuels. This book is the result of that study.

The author makes a systematic analysis of population growths and concludes that predictions of future conditions are highly uncertain. In view of this uncertainty the book is devoted to considering maximum plausible demands for low-cost energy based on maximum plausible population in the next 50 to 100 years.

Investigating availability of fuel resources in the form of coal, oil, oil shale, tar sands and natural gas, the author concludes that we cannot satisfy rapidly rising energy demands for a long period. These "capital" forms of energy supply will some day be exhausted at economic levels of production. To supplement these sources the author looks at the "income" forms of energy: solar, wind, fuel wood, farm wastes, water power, heat pumps, ocean temperature differentials, tides and natural steam. He anticipates that only about 7 to 15% of the load can be carried by "income" energy.

Under the present pattern that seems to be shaping up economically, it appears that nuclear fuels would not be enough to carry more than about 20% of the load. In conclusion the author offers the hypothesis, that by a major electrification of almost all energy consuming devices we could have 15% of the load carried by "income" energy, 25% by "capital" energy and 60% by nuclear fuels. All forms of energy sources should be vigorously developed to meet future maximum energy demands.

Dr J E Hobson, director of Stanford Research Institute, has formally succeeded to the national presidency of Eta Kappa Nu Association, electrical engineering honor society with 22,000 members throughout the world. Hobson succeeds Dr Eric T B Gross of the Illinois Institute of Technology, who has retired.

LEGAL NOTICE

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF

Of Power published monthly (2 issues in September) at New York, N. Y. for October 1, 1954.

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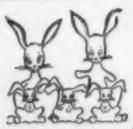
(My commission expires March 30, 1956)



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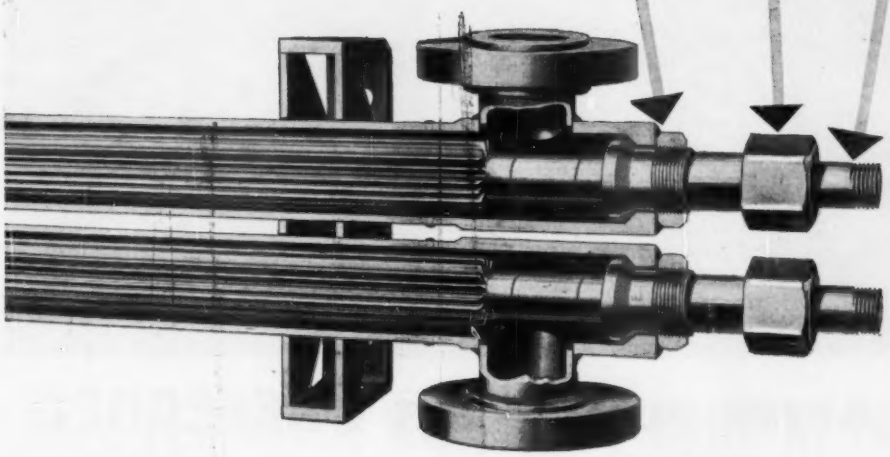

THE G-R TWIN G-FIN® SECTION

A **CONE PLUG LOCK NUT**

B **UNION NUT**

C **MALE TAILPIECE**

These are the only parts in the complete head assembly of the G-R Twin G-Fin Section. Similar simplicity is inherent in every other feature, such as:

Simple Design—Consists essentially of a pipe within a pipe, without the complications of tube sheets, baffles and internal joints.

Simple Installation—These lightweight, standard, interchangeable units can be easily stacked and connected in series or parallel for the desired capacity and temperature ranges.

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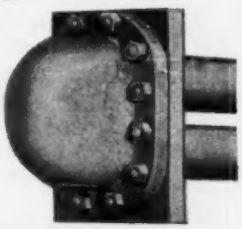
Domed Shell Cover—This type of shell cover is particularly rugged, yet weighs only 17 pounds for the small sections and 43 pounds for the standard high capacity sections.



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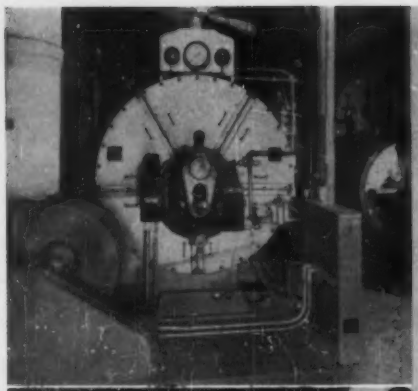
THE GRISCOM-RUSSELL CO., MASSILLON, OHIO

G-R HEAT TRANSFER APPARATUS **Twin G-Fin Section**

GR-337



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This 150 HP Preferred Unit Steam Generator, burning #6 oil, heats 200,000 sq. ft. plant. Replaced two 90 BHP "package" boilers burning #2 oil. Saves 50% in fuel costs.

METAL PRODUCTS PLANT

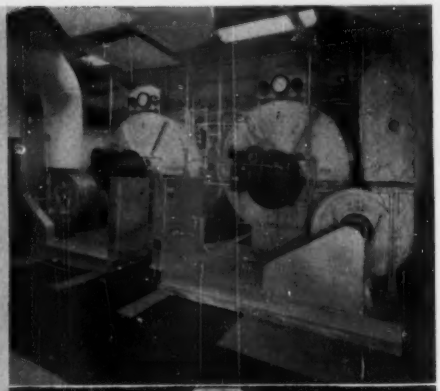
First ordered two 150 HP Units. Their dependable, economical performance soon led to another . . . then a fourth . . . and a fifth, all in less than 5 years.

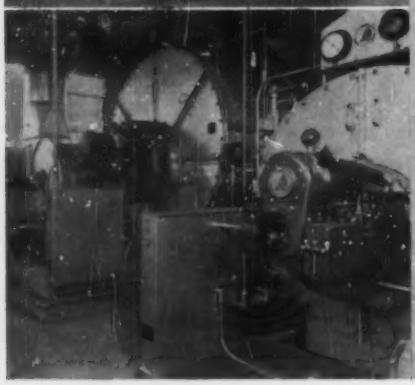
BURLAP & BUCKRAM PLANT

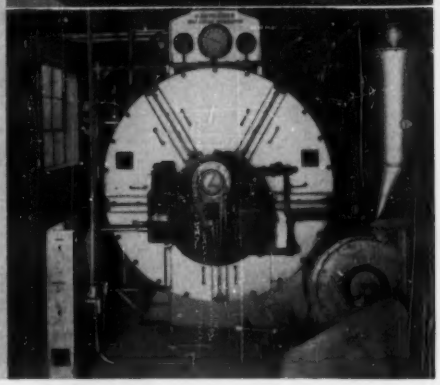
"I can't remember any maintenance that has cost us any downtime, or any cash. We have saved a considerable amount of money on steam expense. Very pleased about ease of operation of these units."

LARGE DAIRY

"Reliability and a minimum of maintenance are of prime importance and, with our Preferred Unit Steam Generator, we have achieved this goal . . . The low stack temperature that is consistently below your guarantee is a constant reminder that we are sending a minimum of heat up the stack."







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For Lower Installation Cost • Greater Operating Efficiency
Lower Fuel Cost • Minimum Maintenance

Experience proves that for economical, trouble-free, long-life service – no "package" boiler matches the performance quality and important engineering "extras" of the Preferred Unit Steam Generator.

ALL THESE FEATURES MAKE THE DIFFERENCE:

1. Four Pass, High Velocity Gas Travel assures maximum heat absorption.
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8. Expansile Precipitator assures safe, clean operation.
9. Dual Purging Action eliminates stratification of combustion gases.
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Your plant will profit from the advantages these built-in Preferred design features offer. Bulletin 2000 tells why. Write for a copy.

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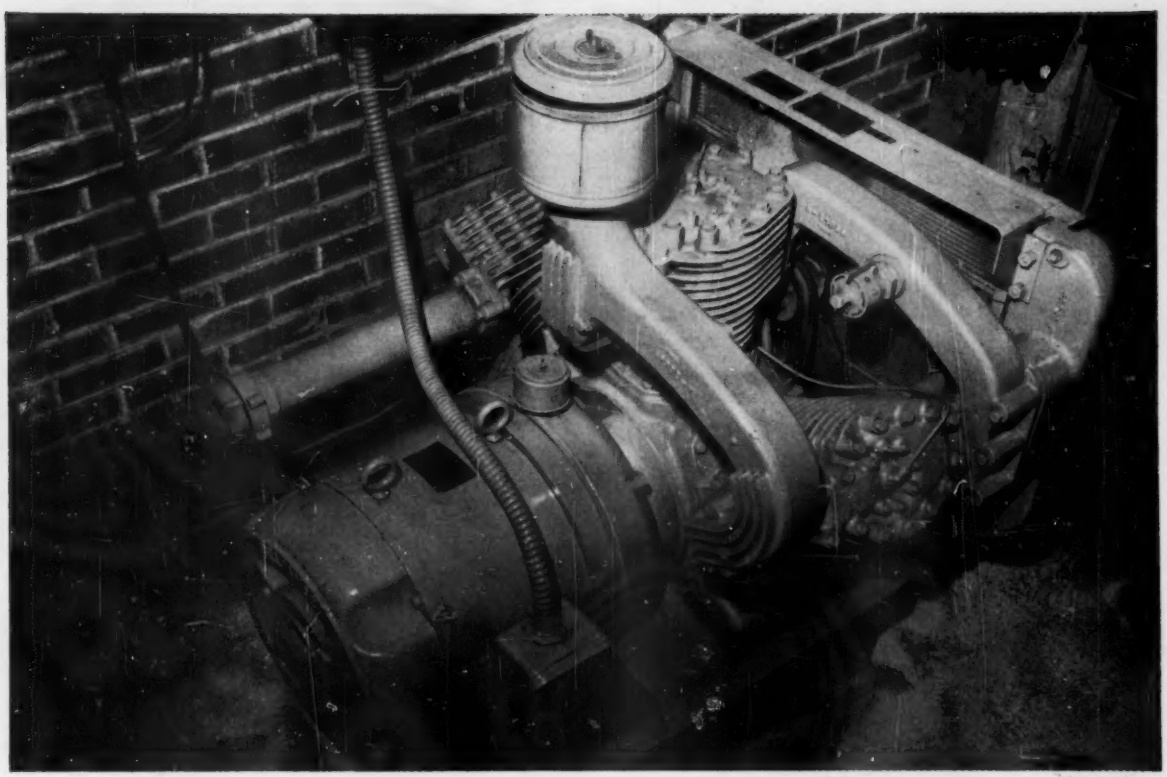
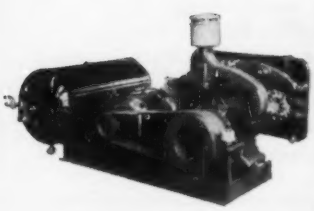


SAVE ALMOST A MILE EVERY HOUR* IN PISTON WEAR WITH A JOY WL-80 COMPRESSOR—

** Piston speed is lower than that of four comparable compressors. So low that you save over 6½ miles of wear each 8-hour day.*



Joy WL-80 "Packaged Unit" Compressor can be delivered ready-to go, complete with air receivers, piping and wiring.

NEED A SMALL, COMPACT COMPRESSOR as an auxiliary air supply? Or possibly you want a compressor that can be placed right where the air is used and eliminate long runs of piping.

If your requirements call for 640 CFM or less, there's a Joy WL-80 for you:

- *15 to 125 HP.*
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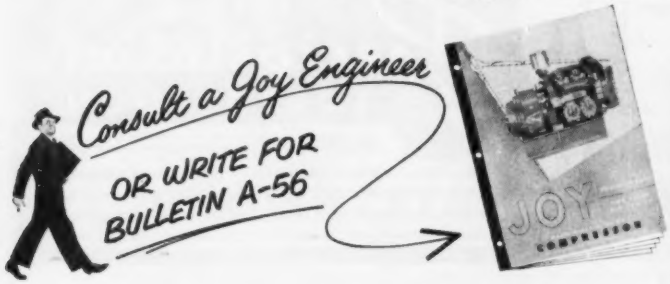
- *Eleven models.*

. . . And, you have your choice of drives: Direct, V-Belt, Flange-Mounted. In fact, these compressors are available as packaged units, like that shown at the left, delivered complete with air receivers, piping and wiring.

* * *

Get full details by writing for Bulletin A-56. ● **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*



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. . . and many other helpful facts on Cottrell design and operation.

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A copy of this data-packed booklet will be sent free to engineers and other executives interested in recovery processes. Send your request to our nearest office.

For nearly 50 years Western Precipitation has carried on a continuous research and development program on Cottrell Electrical Precipitators, Multiclone Mechanical Collectors and other types of recovery equipment. We are not affiliated with any other company in the electrical precipitation field except our wholly owned subsidiaries, International Precipitation Corporation and the Precipitation Company of Canada, Ltd. We are equipped to serve you anywhere in the United States, Canada, and throughout the world!

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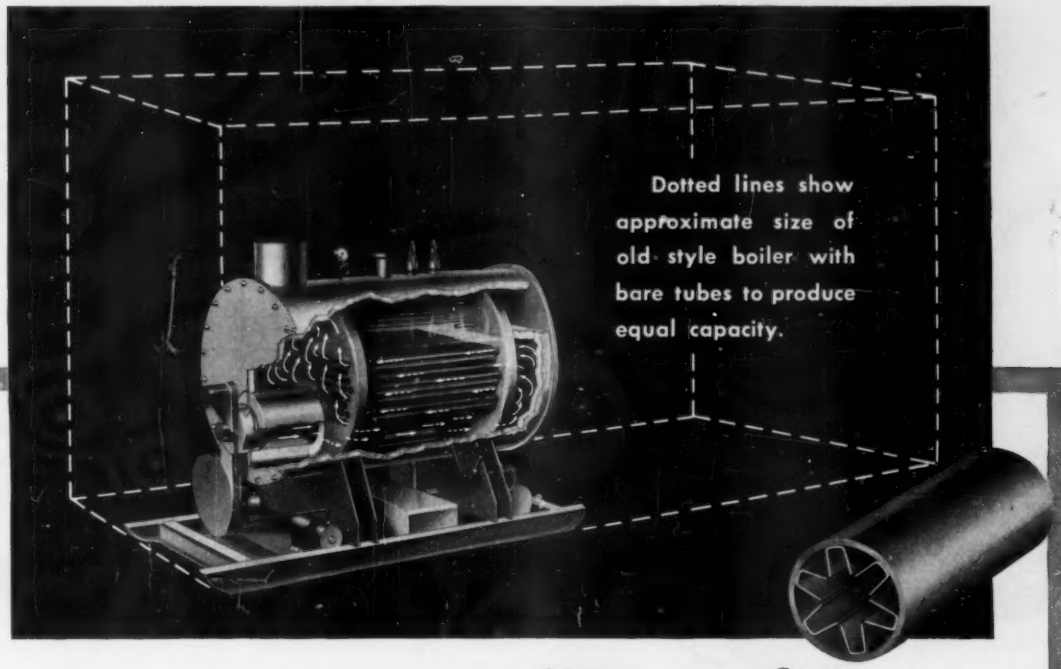

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with integrally finned tubes provides greater capacity in less space

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Now, these same proven economies of the extended surface finned tube have been applied to transferring heat in boilers, where extended surface tubing offers so many advantages.

Due to having much greater fire-side to water-side surface ratio than plain bare tubes — and producing greater turbulence — our boiler extracts the needed heat from the hot gases in just **one pass** through a **short tube.**

This results in much reduced forced draft and stack requirements. The boilers produce more steam from less floor space, and less cubic space. They can be installed where headroom is limited — with consequent additional savings in building costs — come up to full steam pressure in about 10 minutes — require little maintenance.

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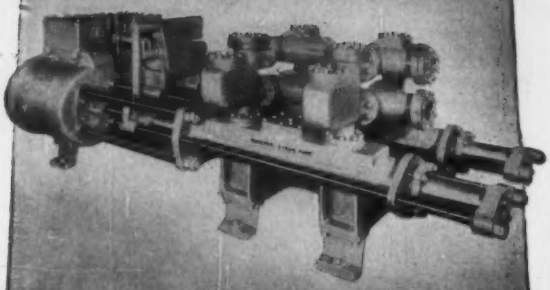

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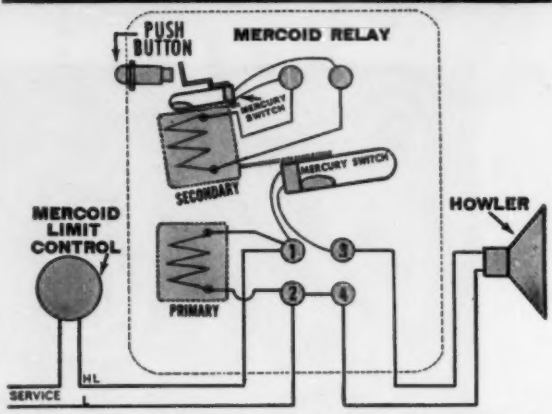
packing more performance into every application

PALMETTO Packings

GREENE, TWEED & CO. North Wales, Pa.

MERCOID RELAY FOR AUDIBLE ALARM



When Limit Control closes its circuit, current is supplied to primary coil of Mercoid Relay and through the normally closed mercury switch to the "Howler" (alarm). To stop "Howler," operator pushes in "push button" which manually raises relay secondary and breaks circuit to "Howler." Secondary is held up by magnetic repulsion until condition is corrected. When limit control opens the primary circuit of relay, secondary coil drops to normal position and relay is automatically ready for another operation.

WRITE FOR BULLETIN CA-8R

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Condense and filter
... if you want "INSTRUMENT-QUALITY" Compressed Air

HANKISON
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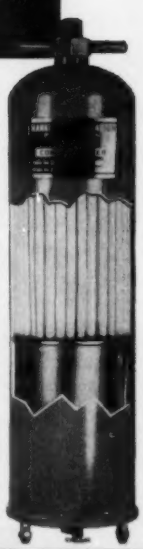

Sets years-ahead filtering standards. When your problem involves Clean, Dry, Air to obtain more efficient, dependable instrument operation, the Hankison Condensifilter offers you a practical low cost solution.

Hankison Condensifilters give greater overall efficiency through these engineering extras -

- Twin Action Principle, that both filters and dehydrates.
- "O" ring seal construction.
- Low maintenance cost.

See why maintenance men are specifying Condensifilters. A qualified engineer is available to consult with you on all compressed air problems.

HANKISON CORPORATION

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Two CP Diesels Keep The "Follies" on Ice

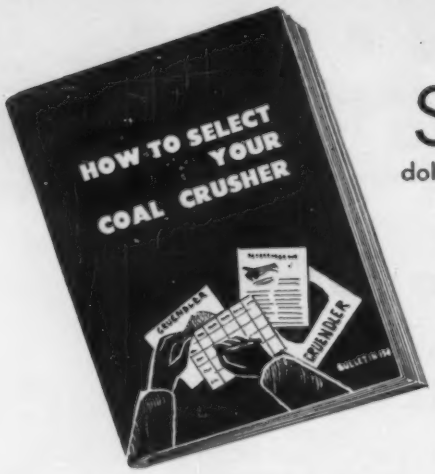
Here's an example of CP performance and reliability—a pair of Chicago Pneumatic Model 68 diesel engines that generate over an estimated 1,000,000 kwh a year for The New Haven Arena. Besides furnishing light and power for the entire arena consisting of auditorium, parking garage, service station, ice plant, block of stores, and executive offices, they also drive two 10 x 10 ammonia compressors for the manufacture of commercial ice in the summer and refrigeration for rink ice skating in the winter.

Rated at 180 hp, 600 rpm, these engines are typical of many CP installations where multiple power requirements call for absolute dependability and low operating cost. CP diesel, dual-fuel and gas engines are available in sizes capable of delivering from 120 hp to 1750 hp. For more details write *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, New York.*

One of the two CP Model 68 diesel engines generating light and power for The New Haven Arena.

Chicago Pneumatic
PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

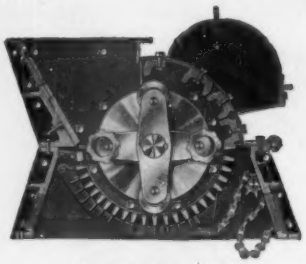
FREE! *This New and Informative Booklet on* COAL CRUSHERS *for* POWER PLANTS AND MINES



Selecting the type of coal crusher that will best serve your special needs can be the means of saving thousands of dollars in operating and maintenance costs.

This new "how" booklet gives down-to-earth facts and figures — shows you how to determine the convenient type and capacity of coal crusher that will serve your needs most effectively — to produce the greatest possible yield at the lowest possible cost.

Write or wire for your FREE copy. No obligation.

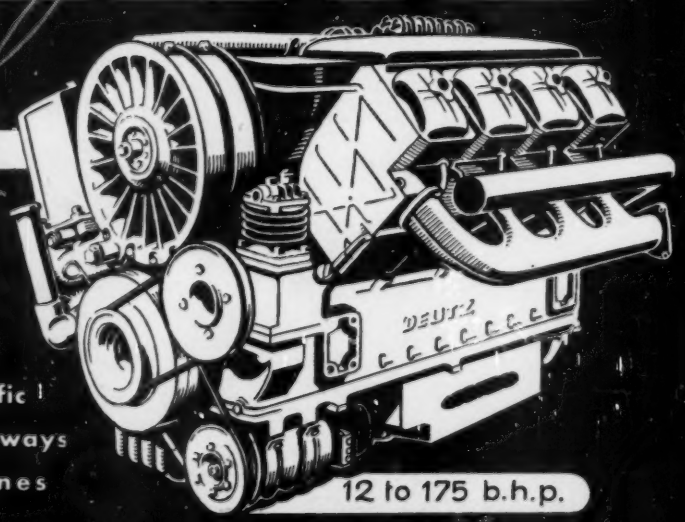


Illustrating Gruendler Ring Hammer Crusher

GRUENDLER CRUSHER & PULVERIZER CO.
2915-2917 NORTH MARKET STREET ST. LOUIS 6, MISSOURI

DEUTZ *Diesel*

air cooled



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road and rail traffic
ships on all water-ways
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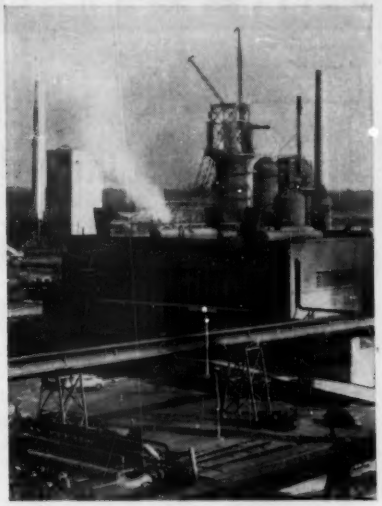
Capsule Case History:

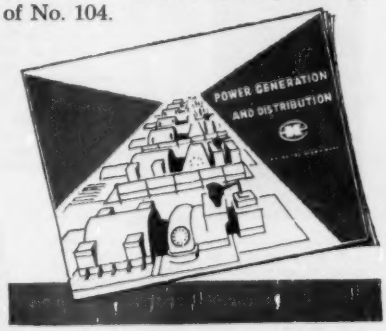
...before you leap

A careful look by Kaiser Engineers often results in departure from traditional methods in developing plant designs that anticipate the client's needs for future expansion and improvements. Numerous examples of this type of cost-saving engineering foresight are to be found in work performed by Kaiser Engineers in the broad fields of industrial design and construction.



To Make More Steel You Need More Steam and in this rapidly growing steel plant, engineering foresight provided the needed expansion with both downtime and costs kept at a minimum. When a fourth 160,000 lb/hr boiler was installed, foundations and utilities were laid anticipating a fifth. This boiler was later installed with resultant savings for the operators. With Kaiser Engineers, provision for expansion is a standard approach.

A new power brochure, outlining Kaiser Engineers' experience in generation and distribution, will soon be published. Write today for your copy of No. 104.



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AIR POLLUTION

How To Make Your Smoke Stack Act Taller Than It Is!

New wind operated, automatic controller energizes forced draft or heat systems under unfavorable meteorological conditions . . . thereby increasing "effective stack height." It's called The Bendix-Friez Windtrol*.

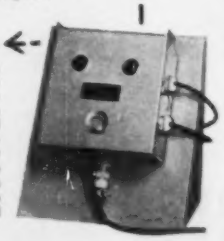
For example, the plant that we're talking about has a relatively low stack. The release of fly ash with its stack effluent results in many complaints under certain meteorological conditions. How can this be corrected . . . without great expense? Let's see what the principles of stack meteorology can show us.

By checking wind speed and direction . . . unfavorable quadrant can be discovered. First, you install at near stack height the Bendix Windtrol Transmitter. This detects the wind speed and direction. The unfavorable quadrant is established for air pollution and the controller (located indoors on any convenient wall) is wired accordingly. The controller is then connected to a forced draft fan, a booster blower or a stack oil burner.

HOW IT WORKS

The transmitter of the Windtrol has been constructed so that the controller circuit is energized when the wind speed is less than a selected value, and the wind direction is from a specified arc. Normally, it is wired so that both conditions must exist simultaneously for the circuit to be energized.

Observations indicate that many situations will arise because of the gustiness of the wind in which either or both, the direction and speed will oscillate rather rapidly in the vicinity of the selected limits. This could result in intermittent and short period closures of the controlling circuit, were it not for a built-in time delay device which causes the actuating power relay to remain open or closed for a given length of time after the direction or speed has changed from the required limits.



For further information, write today.

*Pat. Appl. for

Bendix - Friez

FRIEZ INSTRUMENT DIVISION OF BENDIX AVIATION CORPORATION
1461 TAYLOR AVENUE, BALTIMORE 4, MARYLAND
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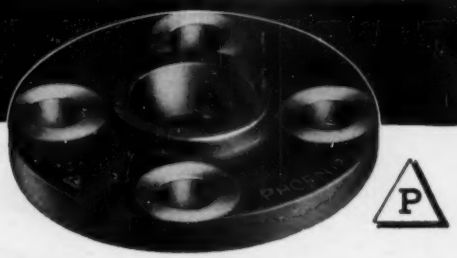
PHOENIX *Drop-Forged* FLANGES MEAN . . .

MAXIMUM STRENGTH



Long life is assured with Phoenix maximum strength flanges. Forged of mild steel, they are available in a wide range of styles and sizes. Meet ASA requirements and ASME and ASTM specifications.

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Send for free brochure showing Phoenix Complete Line.

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build your future on what you know

DEARBORN WILL TRAIN YOU AS A SALES ENGINEER. If you are 30 or older...with several years' experience in power plant operation...and desire to improve your earnings, we want to hear from you.

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If you qualify and are interested, write or phone for a confidential interview.

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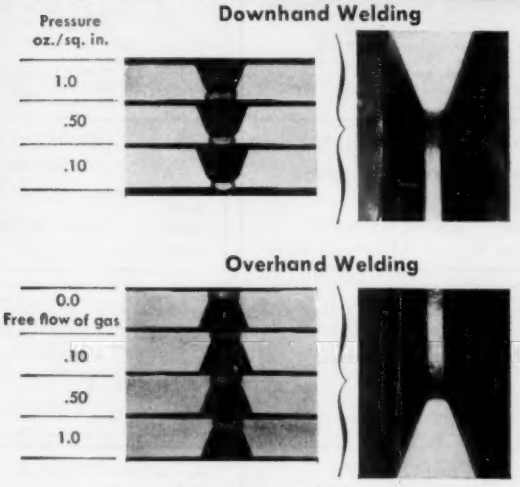
INERT GAS TUNGSTEN ARC-WELDING
ON HIGH-TEMPERATURE, HIGH-PRESSURE PIPING

It's a Standard Production Procedure at Pittsburgh Piping

Inert gas tungsten arc-weld root pass on 2¼% Chrome—1% Moly steel turbine connection for 1000°F service.



Slight variations in internal inert gas pressure make great differences in contour of root pass. Skill of operator and welding groove details are of greater importance than gas pressure.

Inert gas tungsten arc-welding is a technique which has been long and successfully applied to high-temperature, high-pressure piping at P.P.&E. Used for the first pass, it eliminates need for backing rings and double butt welding, assures full penetration and fusion, and produces a joint having a smooth inner contour that requires no grinding.

Pittsburgh Piping's process provides an inert gas shield on both external and internal surfaces of the root pass. This complete protection against oxidation results in an outstandingly uniform inside bead.

The success of the inert gas tungsten arc-welding process hinges on the welder's skill, and correct application of the many other fabricating techniques developed by Pittsburgh Piping.

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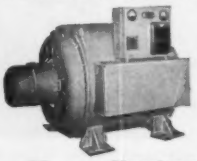

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MIDCONTINENT TUBE SERVICE, INC.
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High Pressure Rubber Gaskets
ALL SIZES TO FIT YOUR GAGES & VALVES

ERNST WATER COLUMN & GAGE CO.
Send for Catalog — LIVINGSTON, N. J.

Giant drawbenches in Bridgeport's new tube mill draw five tubes at a time in extremely long lengths.

Aerial view of new Bridgeport Tube Mill at Bridgeport, Conn., with the most modern drawing facilities in the U. S.

Coming...

Long Length Condenser Tubes

FROM BRIDGEPORT BRASS

Condenser tubes in extra long lengths will be rolling off the drawbenches in Bridgeport's modern new tube mill — beginning in January, 1955.

These new, long length tubes will be made to the same exacting standards as regular length Bridgeport Condenser Tubes, and backed by the many years of successful operation in a wide range of applications. The same proved Bridgeport alloys, Inhibited Admiralty and Muntz, Aluminum Brass, Duronze IV (Arsenical Aluminum Bronze) and Cupro-Nickel will be available in these extra length tubes. Facilities are also available for bending tubes for feedwater heaters and other applications.

Bridgeport's new tube mill and the long lengths made possible by the huge drawbenches included in its facilities are another example of Bridgeport's progress in the field of condenser tube manufacture and in corrosion research. For additional information on Long Length Tubes or regular tubes and for assistance from our Technical Service, get in touch with the nearest Bridgeport Sales Office.

Want to receive our monthly Copper Alloy Bulletin regularly? Ask us to add your name to our mailing list. The Bulletin contains news about the latest developments in the condenser tube field and useful design and maintenance helps.

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SALARIED PERSONNEL, $3,000-$25,000. This confidential service established 1927 is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 241 Orange St., New Haven, Conn.

POSITIONS WANTED

CHIEF WATCH Engineer: 15 years power plant operation with one company—high and low pressure., Desire relocation in new or expanding plant with advancement possibilities. Married. 41 years of age—present salary $450 monthly. PW-4443, Power.

CHIEF ENGINEER with 28 years experience in the operation and supervision of power plants desires position in operation, maintenance, starting, tests, betterment, personnel training, etc., Technical education. Gold seal N. J. lic., free to travel. PW-4491, Power.

SELLING OPPORTUNITY WANTED

MANUFACTURER'S REPRESENTATIVE experienced valves and regulators desires additional account power plant equipment. Western Penna. RA-4637, Power.

OFFICIAL PROPOSALS

BIDS: December 17, 1954

POWER AUTHORITY OF THE STATE OF NEW YORK CONSTRUCTION OF CONSTRUCTION POWER FACILITIES

NEAR MASSENA, ST. LAWRENCE COUNTY, NEW YORK
SPECIFICATION NO. PA-5-14036
ST. LAWRENCE CONTRACT NO. 7

NOTICE TO CONTRACTORS. The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the construction of construction power facilities near Massena, St. Lawrence County, New York until 10:30 a.m. Eastern Standard Time on the 17th day of December, 1954 at the Authority's office, 270 Broadway, Room 1207A, New York 7, New York, at which time and place proposals will be publicly opened and read aloud.

The principal items of work are:

1. A 115 KV transmission line, 3-phase, single circuit, approximately 3 miles long on H-frame wood poles. The conductors will be No. 3/0 A.C.S.R. The line will also be provided with a static line which will be installed on top of one of the poles of the H-frame and strung the whole length of the line.
2. Approximately 3.7 miles of double circuit, 3-phase 13.8 KV transmission line on H-frame wood poles. The six conductors for this line will be 336,400 circular mil A.C.S.R.
3. A 115-13.8 KV substation consisting of erection of two 10,000 kva, 3-phase, oil-filled transformers, and necessary bus work, disconnecting switches and fuses for six 13.8 KV, 3-phase circuits. The structure to be furnished by the Contractor for this installation may be either wood or steel.
4. Two 13.8 KV load centers consisting of 3—3-pole, gang-operated pole top mounted load break switches and bus work arranged to receive two incoming 13.8 KV, 3-phase circuits. The structure will be wood.

Plans, specifications and Proposal Forms for the work are on file in the Authority's Office and in the offices of the Engineer, Uhl, Hall & Rich, 230 Congress Street, Boston 10, Massachusetts, and the Hydro-Electric Power Commission of Ontario, 620 University Avenue, Toronto 2, Ontario, and may be inspected by prospective bidders during office hours.

Plans, specifications and Proposal Forms may be obtained from the Power Authority of the State of New York, 270 Broadway, Room 1300, New York 7, New York, after November 26, 1954 upon application and prepayment of a fee of Twenty-five ($25.00) dollars, no part of which will be refunded.

Bids must be made upon the proposal forms included in the Contract Documents. Each proposal must be accompanied by draft or certified check payable to the order of the Power Authority of the State of New York for the Sum of $15,000.00.

The right is reserved to reject any or all bids.

W. S. CHAPIN
GENERAL MANAGER

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Individual Spaces with border rules for prominent display of advertisements.
The advertising rate is $16.25 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

New Ads: Send to 330 W. 42nd St., New York 36, N. Y. for January issue closing December 10th.

OFFICIAL PROPOSALS

BIDS: January 5, 1955

POWER AUTHORITY OF THE STATE OF NEW YORK ST. LAWRENCE POWER PROJECT FOR THE FURNISHING AND DELIVERY OF 71,000 HP HYDRAULIC TURBINES

SPECIFICATIONS NO. PA-4-15001
ST. LAWRENCE CONTRACT NO. P2

NOTICE TO CONTRACTORS: The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the design, manufacture, and furnishing of 71,000 HP hydraulic turbines and delivery thereof f.o.b. Massena, New York, until 10:30 A.M. Eastern Standard Time on the 5th day of January, 1955 at the Authority's office, 270 Broadway, Room 1207A, New York 7, New York, at which time and place proposals will be publicly opened and read aloud.

Bids will be entertained for 4, 8, 12 or 16 turbines and associated equipment and services in accordance with the bidding schedules. Erection at the site of installation will be done by others but services of erection engineers and mechanics shall be provided by the manufacturer if and when required.

Bids will not be restricted to American manufacturers.

Plans, specifications and Proposal Forms for the work are on file in the Authority's Office and in the offices of the Engineer, Uhl, Hall & Rich, 230 Congress Street, Boston 10, Massachusetts and the Hydro-Electric Power Commission of Ontario, 620 University Avenue, Toronto 2, Ontario, and may be inspected by prospective bidders during office hours.

Plans, specifications and Proposal Forms may be obtained from the Power Authority of the State of New York, 270 Broadway, Room 1300, New York 7, New York, after November 15, 1954 upon application and prepayment of a fee of Fifteen ($15.00) dollars per set of two bound copies of Contract Documents, no part of which will be refunded.

Bids must be made in duplicate upon the proposal forms included in and bound with the Contract Documents. Guarantee will be required with each bid in an amount not less than 10 percent of the maximum price bid for any bid schedule.

The right is reserved to reject any or all bids.

W. S. CHAPIN
GENERAL MANAGER

BIDS: January 6, 1955

POWER AUTHORITY OF THE STATE OF NEW YORK ST. LAWRENCE POWER PROJECT FOR THE FURNISHING AND DELIVERY OF 60,000 KVA ALTERNATING CURRENT GENERATORS

SPECIFICATIONS NO. PA-4-14001
ST. LAWRENCE CONTRACT NO. P3

NOTICE TO CONTRACTORS: The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the design, manufacture, and furnishing of 60,000 KVA alternating current generators and delivery thereof f.o.b. Massena, New York, until 10:30 A.M. Eastern Standard Time on the 6th day of January, 1955 at the Authority's office, 270 Broadway, Room 1207A, New York 7, New York, at which time and place proposals will be publicly opened and read aloud.

Bids will be entertained for 4, 8, 12 or 16 generators and associated equipment and services in accordance with the bidding schedules. Erection at the site of installation will be done by others but services of erection engineers shall be provided by the manufacturer if and when required.

Bids will not be restricted to American manufacturers.

Plans, specifications and proposal forms for the work are on file in the Authority's Office and in the offices of the Engineer, Uhl, Hall & Rich, 230 Congress Street, Boston 10, Massachusetts, and the Hydro-Electric Power Commission of Ontario, 620 University Avenue, Toronto 2, Ontario, and may be inspected by prospective bidders during office hours.

Plans, specifications and proposal forms may be obtained from the Power Authority of the State of New York, 270 Broadway, Room 1300, New York 7, New York, after November 19, 1954 upon application and prepayment of a fee of Twenty-five ($25.00) dollars per set of two bound copies of Contract Documents, no part of which will be refunded.

Bids must be made in duplicate upon the proposal forms included in and bound with the Contract Documents. Guarantee will be required with each bid in an amount not less than 10 percent of the maximum price bid for any bid schedule.

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WANTED

500 to 800 Ton Centrifugal Refrigeration Compressor, motor 4160 Volts. State condition, location & price.

POWER W-4640
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FOR SALE

1—General Electric AC Turbine generator unit with condenser. 1875 KVA, 3 phase, 60 cycle, 2400 volts, 160 lbs.

MT. CARMEL PUBLIC UTILITY CO.
Mt. Carmel, Ill.

359 KVA DIESEL UNIT

1—359 KVA Fairbanks Morse Generator, 3 phase, 60 cycle, 2400/480/240 volts, 514 RPM direct connected to
1—420 HP Fairbanks Morse diesel engine, model 31A8½. 514 RPM.

New 1949—Excellent condition.

INTERNATIONAL POWER MACHINERY CO.
1610 Union Commerce Bldg., Cleveland 14, Ohio

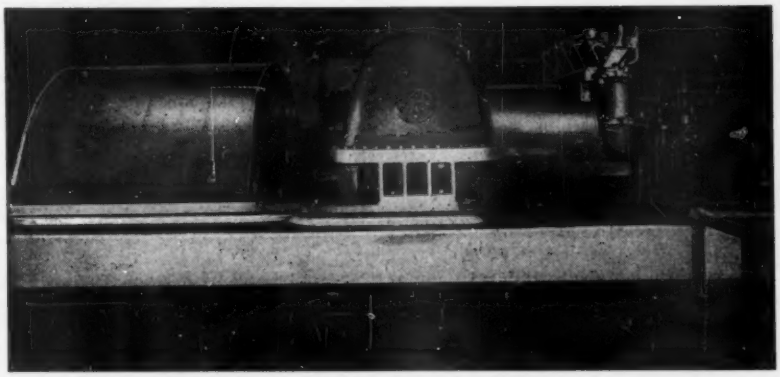
3750-KVA. ALLIS-CHALMERS-400# PSIG, 750° F.T.T. TURBINE-GENERATOR NEW 1948-EXCELLENT CONDITION

Above view of our Allis-Chalmers 3750 KVA Condensing Turbine Set, just released, offered here for the first time. Is complete with 2-pass Surface Condenser capable condensing 34,500# steam per hour, Switchboard with Instruments, Exciter direct connected and has had limited service and ready now for immediate delivery. Voltage: 3/60/2300/4160 Volt. Steam Pressure: Initial 400# PSIG, 750° F.T.T.

OTHER UNITS AVAILABLE:

1—2000 KW Gen. Elect. Cond.—440#—750° F.T.T.—2300 V.
1—2000 KW Al.-Chal. Cond.—400#—750° F.T.T.—2300 V.
1—1500 KW Gen. Elect. Cond.—410#—750° F.T.T.—2300/4160 V.
1—2000 KW West., Non-cond.—250#—600° F.T.T.—40# B.P., 2300 V.
1—1250 KW West., Non-cond.—150#—600° F.T.T.—15# B.P., 2300 V.
1—1250 KW Gen. Elect., Non-cond.—200#—600° F.T.T.—15# B.P., 480 V.
2— 750 KW West., Non-cond.—150#—600° F.T.T.—15# B.P., 2300 V.

3750 KVA. - G. E., 400#, 750° F.T.T. TURBINE-GENERATOR



Above view was made from a recently taken photograph of the 3750-KVA, G.E., Turbine. It is a condensing machine complete with 2-pass, 6000 sq. ft. Surface condenser, Switchboard with Instruments, D.C. Exciter. Voltage is 3/60/2300-4160-V.

MACHINE CAN BE INSPECTED IN OPERATION

We own and offer any Capacity Turbine from 300-KW to 12,500-KW. Complete line of Boilers, also Diesel Engines. Send us your specs.

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4145 PENOBSCOT BUILDING
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QUALITY and ECONOMY are quickly found in

HEMPHILL *Guaranteed* EQUIPMENT

OIL CIRCUIT BREAKERS

3—600 AMP. G. E. FKR-55-20, 15,000 V. 3 P. 100,000 KVA, SOLENOID OPER.

TRANSFORMERS—60 Cycle

Qu.	KVA	Make	Type	Ph	Voltages
2	3750	G.E. new	OISC	3	26,400x4360
1	1000	G.E.	Auto	3	4150x2400
1	1000	Amer.	OISC	3	4160x480
1	750	G.E.	HT	3	4150x120/240
2	750	G.E.	H	1	4600-120/240
1	600	Kuhl.	OISC	1	4150x2400
2	400	Pitts.	OISC	1	4800/4150/2400 x240/480
1	333	G.E.	H	1	13200x220/440
3	300	G.E.	H	1	13200x440
4	200	G.E.	H	1	13200x440
1	200	G.E.	HT	3	2400x240
2	150	Pitts.	ODSC	1	240x120/240
3	50	G.E.	H	1	4800x120/240
3	50	A.C.	H	1	230x120/240
3	50	G.E.	H	1	460x115/230
3	50	Whse. new	OISC	1	2400x240/480
2	37½	G.E.	H	1	2400x120/240
1	25	G.E.	H	1	460x120/240
3	25	Niag.	OISC	1	2300x480
1	25	Allis	PBSR	1	490x12240

SLIP RING MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	500	G.E.	1200	M	2400/4150
1	400	Whse.	450	CW	550
1	250	Whse.	60	CW	440
2	200	Whse.	600	CW	440
1	200	G.E.	600	MT	440
1	150	A.C.	1800	AT RW	2300
1	100	G.E.	1800	IM	220
1	100	G.E.	600	IM	440
1	75	G.E.	600	IM	440
3	60	G.E.	1800	MT	220

DC, 230 VOLT MOTORS

Qu.	H.P.	Make	Speed	Type
1	300	G.E.	1200	MPC
2	150	C.W.	900	WP
1	125	G.E.	1700	BC
2	75	C.W.	900	WP
1	30	C.W.	700	CM
1	35	G.E.	860	BC
1	25	Whse.	835	SK

NEW COMPLETE OUTDOOR SUBSTATION

2—3750 KVA, G.E. type OA, 4687 KVA forced air, 26400 volts pri., 2 taps above and below, 4360/2520 volts sec. with fans, steel structure, outdoor, 1-million KVA interrupting breaker, etc. Purchased 1951, never used.

- **THE HEMPHILL SEAL OF** *Satisfactory* **SERVICE**

JLHCo

THIS SEAL GUARANTEES INSPECTION BY HEMPHILL ELECTRICAL ENGINEERS

Member of The National Industrial Service Association, Inc.

FOR POWER

J. L. HEMPHILL & CO.

1603 54th STREET, NORTH BERGEN, N. J.

PHONE NEW YORK LONGACRE 5-3737

PHONE NEW JERSEY UNION 5-3848

Qu.	KW	Make	Speed	DC	AC
1	1000	G.E.	514	600	2300/4150 Syn.
1	1000	Whse.	720	600	2300/4150 Syn.
1	750	Whse.	720	275	2300/4150 Syn.
1	300	C.W.	1200	230	3-unit 2400/4150SR
1	300	G.E.	1200	230	2400/4150SR
1	200	Whse.	900	250	2300/4150 Syn.
1	150	C.W.	1200	230	440 SC
1	150	3 Unit G.E.	1200	125/250	2300 Syn.
1	150	Whse.	600	125	4150 Syn.
1	125	C.W.	1200	125	2300 S.C.
1	100	G.E.	900	250	2300 Syn.
3	60	G.E.	1200	125	208 Syn.
2	30	G.E.	1200	125	440 SC

SYNCHRONOUS MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	400	Whse.	450	HR	550
1	250	Whse.	450	HR	440
1	200	Ex. Mach.	720	TEFC	2300
3	200	Whse.	720		4150
1	175	G.E.	720	ATI	2300
1	150	G.E.	720	ATI	2300
1	150	G.E.	1800	TS	220
1	150	Whse.	900	ISIC	220

SPECIAL

A.C. Welding MG Set

176 KVA 1200 RPM 1 Phase 220 V. 800 Amps. 57 PF motor 1160 RPM. 440 2 3 Ph. S.R. direct connected exciter and flywheel.

REBUILT—GUARANTEED ELECTRICAL EQUIPMENT

Several Larger Items Selected from Our Stock

MOTOR GENERATOR SETS

Qu.	KW.	Make	R.P.M.	Volts D.C.	Volts A.C.
1 (3-U)	2400	Whse.	720	600	4800/2400
2	1200	Whse.	720	600	2300
1	500	C.W.	720	275	2300/440
1	400	C.W.	1200	125/250	440
1	300	G.E.	720	275	2300
2	200	G.E.	720	250	2300/440
1	150	G.E.	720	250	2300/440
1	100	Whse.	900	275	2300
1	100	C.W.	1200	125	440/220
1	85	C.W.	1200	250	4000/2200

SYNCHRONOUS MOTORS

3-Phase, 60-Cycle

Qu.	H.P.	Make	P.F.	Volts	R.P.M.
1	3000	Whse.	.80	4300/2400	720
2	2100	G.E.	1.00	2300	360
2	2000	G.E.	.80	2200	720
1	800	El. Mchy.	.80	440	1200
1	750	G.E.	.80	2300	450
1	300	G.E.	.80	440/220	900
1	250	G.E.	1.00	2300	514
1	250	Whse.	.80	440	600
2	200	Whse.	.80	440	1200
1	187	G.E.	.80	440	720
1	150	Whse.	.80	440/220	450
2	135	G.E.	.80	4000/2200	1200

TRANSFORMERS

Qu.	KVA	Make	Phase	Voltage
3	750	Pitts.	1	23,000-2300
3	667	Wagner	1	22,000/11,000-2300/4000
3	540	G.E.	1	22,000/11,000-2300/4000
3	333	G.E.	1	13,200-2300
3	250	G.E.	1	2400-240/480
2	150	G.E.	1	2400/4150-240/480
3	100	G.E.	1	23,000/2300

T.B. MAC CABE COMPANY

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AMERICAN AIR OF JERSEY

AIR FOR SALE OR RENT

SINCE 1902

GAS • DIESEL • STEAM • ELECTRIC

NEW AND QUALITY REBUILTS

STATIONARY

80 CFM 6x5 Worthington HB—10 HP Elec.
122 CFM 7x7 Worthington HB—20 HP Elec.
170 CFM 6¼x4½ Davey VB9—25 HP Elec.
242 CFM 125 PSI 8x7 Joy WG-9—40 HP Elec.
270 CFM WL-60 Joy Gas and Elec 50 HP
294 CFM 125 PSI 10x11 Worthington HB
364 CFM 20 PSI 12x7 Gardner Denver RX
368 CFM 100 PSI 12x10 IR-ER-1
552 CFM 125 PSI—13/8x10 Ingersoll Duplex
931 CFM 55 PSI 17x13 Chicago T-B
1085 CFM 35 PSI 20x12 Pennsylvania

MANY OTHERS TO CHOOSE FROM
AFTERCOOLERS • AIR RECEIVERS

PORTABLE

35 CFM Lindsay (Gas)
60 CFM LeRoy-Worth (Gas)
105 CFM Joy-Worth-CPT (Gas)
160 CFM Worthington (Gas)
210 CFM Worthington (Gas & Diesel)
270 CFM Joy w/Buda Power Unit—Skids
315 CFM Worthington (Gas & Diesels)
500 CFM Worthington (Diesel)
600 CFM Worthington (Diesel)

VACUUM PUMPS

180 CFM 10x4 Ingersoll—10 HP
354 CFM 14x5 Penn—15 HP
434 CFM 14x7 Ingersoll 15-20 HP
800 CFM 18x9 Worthington—30 HP
1635 CFM 24x11 Chicago—60 HP
5681 CFM 30 & 30x12 Ingersoll XVH (2) Available

American
AIR COMPRESSOR CORP.
DELL AVE. & 47th ST.
NORTH BERGEN, N.J.
Telephone UNion 5-4848

FOR SALE

MODERN 1000 KW Turbo-Generator

in excellent Condition

Non-Condensing, Steel case 80# back pressure .8 P.F., 3 phase, 60 cycle, 4160/2300 volts, alternating current, complete with accessories, switchboard, oil circuit breaker and direct connected exciter. Only operated alternately for six years. Ideal for Chemical, Rubber, Petroleum. Textile, Pulp and Paper, and Sugar Refining Industries.

NEWMAN & COMPANY, INC.
6101 Tacony St. Philadelphia 24, Pa.

DIESEL GENERATOR SETS

3—1400 HP Superior 8 cyl. 360 RPM 1000 KW Elec. Mchy. 3/60/2400 volt generators. Complete Plant. New 1949.

1—750 HP Superior 8 cylinder, 400 RPM, 500 KW Elec. Mchy. 3/60/2400 volt generator & auxiliaries.

1—400 HP Superior 4 cyl. 400 RPM Model VDSE, 250 KW, 3/60/2400 volt.

MISSISSIPPI VALLEY EQUIPMENT CO
507 Locust St. St. Louis 1, Mo.

750 KVA VERTICAL UNIFLOW UNIT

1—750 KVA Allis Chalmers generator, 3 phase, 60 cycle, 4160/2400/480/240 volts, 277 RPM direct connected to

1—Ames 4 cylinder vertical uniflow engine, 150-225 lbs. steam pressure, 0-5# back pressure.

New 1932—Excellent condition.

INTERNATIONAL POWER MACHINERY CO.
1610 Union Commerce Bldg., Cleveland 14, Ohio

RE-NU-BILT
GUARANTEED
ELECTRIC POWER EQUIPMENT

D. C. MOTORS

Qu.	HP	Make	Type	Volts	RPM
1	2200	G.E.	MCF	600	400/500
1	2000	Whse.	Mill	600	230/460
1	1200	G.E.	MCF	600	750/950
1	940	Whse.	QM	250	140/170
1	900	Whse.		250	450/550
1	825	Whse.		250	95/190
1	600	Al. Ch.		250	400/800
1	500	Whse.	CC-216	600	300/900
1	500	G.E.	MCF	600	500/900
2	450	Whse.		550	415
1	200	Whse.	CB-511.3	250	400/800

A. C. MOTORS—3 Ph. 60 Cy.

SLIP RING

Qu.	H.P.	Make	Type	Volts	Speed
1	1500	G. E.	MT-498	2300	360
1	1500	ABB		2300	720
1	1200	G. E.	MT	2300	275
2	1000	A. C.	Mill	2300	240
1	1000	G. E.	MT-452	2200	321
1	500	G. E.	M-574Y	6900	900
1	500	Whse.	CW	550	350
1	400	Whse.	CW-960A	440	1170
1	400	Whse.	CW	440	514
1	400	Whse.	CW-1218	2200	435
1	350	G. E.	MT-442 Y	2200/4000	253
1	350	G. E.	IM-17A	440/2200	720
1	250	G. E.	MT-424-Y	4000	257
1	250	G. E.	MT-559S	2300	1800
1	250	Al. Ch.		550	600
1	200	G. E.	MTP-559	440	1170

SQUIRREL CAGE

2	650	G. E.	FT-559BY	440	3570
2	450	Whse	CS-1420	2300/4150	354
1	300	Whse.	CS	440	1170
1	200	G. E.	IK-17	440	580
3	200	G. E.	KT-557	440	1800
1	150	Whse.	CS-856S	440	880
1	150	Whse.	CS	440	580
1	150/75	G. E.	IK	440	900/450
2	125	Al. Ch.	ARW	2200	1750

SYNCHRONOUS

1	4350	C. W.	3501-SL	13800/6900	514
1	2100	G. E.	ATI	2300	360
2	1750	G. E.	ATI	2300	3600
2	2000	Whse.		2300	120
3	733	G. E.	ATI	2200/12000	600
1	720	G. E.	TS	2300/4600	720
1	500	Ideal	SM	2300/4160	1800
1	500	Whse.		440	900
1	450	Whse.		2200	1285
1	450	Whse.		2200	450
1	400	G. E.	TS	2200	400

M-G SETS—3 PH. 60 CY.

Qu.	K.W.	Make	RPM	DC Volts	AC Volts
2	2000/2400	G. E.	450	250/300	2300/4600
2	2000	G. E.	450	600	2300/4600
1	2000	G. E.	500 25cy	660	11000
2	2000	G. E.	514	600	6600/13200
1	1500	G. E.	720	600	6600/13200
1	1500	C. W.	514	30/115	4000/13000
3	1000	G. E.	720	600	2300/4600
1	1000	G. E.	900	260	6600
1	750	C. W.	514	30/115	2300
1	600	G. E.	720	250	440/2300
1	500	Whse.	1200	115/230	2300

TRANSFORMERS

Qu.	KVA	Make	Type	Ph.	Voltages
1	5000	Whse.	OISC	3	3300x2640
1	2500	Whse.	OISC	3	26400/13200x46
3	2000	G. E.	HVDDJ	1	66000/13800
3	667	G. E.	HD	1	13800x2300
3	1000	G. E.	HVDDJ	1	2400x480
6	1000	Wagner	OISC	1	13200x46

FREQUENCY CHANGER SETS

Qu.	KW	Make	Freq.	Voltages
1	12500	Whse.	60/25	13200/13200
1	3000	G. E.	60/25	2300/2300/4000
2	2500	G. E.	25/62.5	2300/2300
1	1000	G. E.	25/58.3	4400/2300
1	500	Al. Ch.	2560	11000/2300

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	4000	G. E.	Condensing 425—750 F. T. T. Surface Condenser 3/60/2300/4900 V Direct conn exciter
1	1500	Whse.	Auto-extraction 190 lbs.—600# F.T.T. 60 lb. extraction 3/60/240 V. Dir. conn. Exc.
1	1000	Moore	Auto-Ext. Cond. 175/200# I.S.P. 5/20# G. Ext. Surface Condenser—3/60/2300.
1	1000	G. E.	Non-condensing 175/200 lbs. I.S.P. 5/20 lbs. G.B.P. 480/3/60.
1	750	G. E.	Condensing 265# I.S.P. 440V. 3 ph. 60 cy.—New—1944.
1	750	Whse.	—Non-condensing 15# I.S.P. 40# B.P. 750 Kw. 280 V. D.C.

BELYEA COMPANY, INC.
43 Howell St., Jersey City 6, N. J.

NOW IS THE TIME TO BUY....
"Certified Rebuilt" Motors and Generators
HIGHEST QUALITY . . . REDUCED PRICES
Check with WAGNER *First*

A. C. GENERATORS — 60 CYCLE

KVA	Mfr.	Type	Volts	Speed
1000	Whse. syn cond		4000/2300	900
625	Gen. Elec.	ATB	2300	450
600	Gen. Elec.	ATB	480	900
485	Allis Ch.	1 brg.	480	400
440	Gen. Elec.	TRB	240/480	450
312	Gen. Elec.	ATB	240/480	600
275	G. E. 25 cycle	ATI	480	750
225	El. Machy.		480	720
225	Gen. Elec.	ATI	240/480	1200
156	Gen. Elec.		240/480	1200
150	Gen. Elec.	ATB	2300	900
150	Whse.		2300/480	600
125	El. Machy.	Syn.	240/480	1800
125	Gen. Elec.	ATB	240/480	900
112	Gen. Elec.	ATB	240/480	900
75	El. Machy.		2300	900
58	G. E.	ATB	240/480	1200
25	Whse. (3)	3 phase	240	1200
25	Whse. b.b.	1 phase	120/240	900
10	Kato b.b. New	3 phase	127/220	1800

LOW VOLTAGE M-G SET
Whse. 3636 amp. 20/55 V DC gen. w/synch. motor 220/440 V. 720 RPM and exciters.

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Al. Ch.	MECW	125/250	1200
250	Allis. Ch. b.b.	EW	250	1200
250	Gen. Elec.	MPC	250	600
175	Allis Ch. b.b.	EW	250	900
150	Gen. Elec. b.b.	CDM	250	1500
105	Century b.b.	1500 amp.	70	1200
100	G E.	CD	250	1500
100	Allis Ch.	E	125	1200
100	Allis Ch.	EI82	250	900
100	Delco b.b.	Mar.	125/250	1200
75	Whse.	SK160	250	1200
75	Cont. b.b.	D109X	125	1150
75	F. M. b.b.	DH	125	1800
75	G. E. b.b. (2)	CDM135	125	750
75	Whse.	SK	250	900
60	Allis Ch.	E147	250	900
60	Whse. b.b. (2)	SK121	300	1200
50	Cr. Wh. b.b.	CCD	250	1800
50	Reliance	T	250	1150
40	Whse.	SK140	250	1100
40	Gen. Elec.	RC32	600	1750
30	Gen. Elec.	RG	250	900
25	Whse.	SK93	125	1750
25	C. W. b.b. (2)	CCD	250	1200
20	Gen. Elec.	RC	125	1150

A. C. MOTORS — 60 CYCLE

HP	Mfr.	Type	Volts	Speed
800	Allis Ch.	Slipring	440	600
750	G. E.	Synch.	2200	514
700	Allis Ch.	Sq. Cage	440	900
500	Gen. Elec.	Slipring	440	900
500	G. E.	Sq. Cage	4000	1800
500	G. E.	Slipring	2300/440	450
500	G. E.	Synch.	440	900
450	Allis Ch.	Synch.	440	400
400	Cr. Wheeler	Slipring	220/440	1800
400	Whse.	Sq. Cage	2200	514
400	G. E.	Synch.	440	450
400	Allis Ch.	Sq. Cage	2200/440	1200
350	Whse. (2)	Slipring	2300	450
300	G. E. (2)	Slipring	2200/440	720
300	El. Machy	Synch.	220/440	360
300	Al. Ch.	Sq. Cage	2200/440	720
300	Whse.	Synch.	2200/440	600
300	G.E.	Slipring	440	360
250	F. Morse b.b.	Slipring	440	600
250	G.E.	Synch.	220/440	720
250	Whse. (2)	Sq. Cage	2200/440	1200
250	L. A. (2)	Sq. Cage	2200	1800
225	G. E.	Synch.	220/440	900
200	Gen. Elec.	Sq. Cage	220/440	1200
200	F. Morse b.b.	Slipring	220/440	600
200	Reliance b.b.	Sq. Cage	220/440	1800
200	Allis Ch.	Slipring	440	450
200	Gen. Elec.	Sq. Cage	2200/440	720
200	Cr. Wh.	Sq. Cage	220/440	3600
200	Whse.	Sq. Cage	2200/440	900
200	G. E.	Slipring	220/440	600
200	E. M.	Synch.	220/440	1200
200	G. E.	Slipring	220/440	360
200	G. E.	Synch.	220/440	514
175	G. E. (2)	Synch.	220/440	720
175	Whse.	Synch.	220/440	360
150	Whse.	Slipring	220/440	900
150	Whse.	Sq. Cage	220/440	900
150	G. E. TEFC	Sq. Cage	2200	3600
150	G. E.	Synch.	220/440	450
150	Allis Ch.	Slipring	2300/440	720
150	G. E. (2)	Sq. Cage	2200/440	720
150	Allis Ch.	Sq. Cage	2200/440	1200
150	Rel. b.b.	Sq. Cage	220/440	1800
150	Allis Ch.	Sq. Cage	440	450
150	G.E. vertical	Slipring	4000/2300	1200
125	G.E. TEFC	Sq. Cage	220/440	3600
125	Whse.	Sq. Cage	220/440	900
125	Rel. TEFC	Sq. Cage	220/440	1800
125	G. E.	Slipring	220/440	450
125	E. M.	Synch.	220/440	1800
125	Allis Ch.	Slipring	220/440	900
100	G.E.	Slipring	220/440	514
100	Burke b.b.	Synch.	220/440	1800
100	G. E.	Slipring	220/440	900

48 Years of Service to American Industry

D. C. MOTORS

HP	Mfr.	Type	Volts	Speed
300	Allis Ch. b.b.	EW	250	1000
300	Gen. Elec.	MPC	250	500
200	Allis Ch. b.b.	EW	250	650
150	Whse.	SK-201	230	300/900
150	G.E.	RC-16	230	1650
100	G.E.	CD123	230	1150
100	Allis Ch.	E182	230	600/1200
75	F. Morse b.b.	DH-140	115	1800
75	Whse.	SK170	230	635
50	Reliance	310T	230	850
50	Reliance b.b.	651T	230	750
50	Cr. Wh. b.b.	FH	230	1750
50	Whse.	SK185	230	300/900
40	Gen. Elec.	RC31B	230	1750
40	Whse.	SK140	230	775
40	Whse.	SK143	230	600/1500
40	Reliance	651T	230	350/1000
40	Gen. Elec.	RC32	550	1200
30	Imperial b.b.	D69	230	400/1600
30	Star b.b. (3)	6B	230	1750
25	Star b.b.	8B	230	1750
25	L. A. TEFC	RNA	230	850
25	Whse.	SK150	230	300/1200
25	Gen. Elec.	CD106	230	575/1750
25	Whse.	SK100L	230	1150
20	Century b.b.	DN226	230	3500
20	G. E. series	CC-1826	230	875
20	Allis Ch.	E-100	115	1150
15	G.E. (3)	CD75	115	1750

MOTOR-GENERATOR SETS

KW	Mfr.	Input V	Output V
1000	G.E.*	6600 AC	600 DC
500	Whse.*	2300-AC	250 DC
300	Allis Ch.	2200/440 AC	125/250 DC
250	Allis Ch.	2200/440 AC	550 DC
200	Whse.*	220/440 AC	55 DC
200	G.E.*	220/440 AC	250 DC
200	Gen. Elec.*	220/440 AC	125 DC
150	Whse.	2200/440 AC	375 DC
105	Century b.b.	220/440 AC	70 DC
100	G. E.*	2200/440 AC	125 DC
100	Allis Ch.	220/440 AC	250 DC
100	Delco b.b.	220/440 AC	125/250 DC
80	Star* b.b.	220/440 AC	240 DC
75	Cont. b.b.	220/440 AC	125 DC
60	Gen. Elec.*	220/440 AC	60 DC
60	Whse. (2)	220/440 AC	300 DC
50	Gen. Elec.	220/440 AC	125 DC
50	Cr. Wh. b.b.	220/440 AC	240 DC
40	Gen. Elec.	220/440 AC	600 DC
30	F. Morse b.b.	220/440 AC	24 DC
25	Whse.	220/440 AC	125 DC
25	Gen. Elec.	220/440 AC	250 DC
20	Gen. Elec.	220/440 AC	250 DC
15	El. Prod.	220/440 AC	40 DC
15	Star b.b.	220/440 AC	250 DC
12	M.C. b.b.	220/440 AC	125 DC

10,000 other Items in Stock.
Send for our complete listings.

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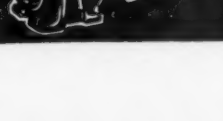

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TELEPHONE MONROE 6-7409

SAVE 50 TO 80% ON THE EQUIPMENT YOU NEED!

with CHICAGO ELECTRIC GUARANTEED "REBUILTS"

WIRE WRITE OR PHONE CAnal 6-2900

POWER EQUIPMENT FOR ALL INDUSTRIAL NEEDS

SYNCHRONOUS MOTORS

3 phase, 60 cycle, 220 or 440 volt (*2300 volts or higher)

H.P.	Make	Type	Power Factor	Speed
1420	*West.		.7	900
720	*West.		1.0	900
710	*G.E.	ATI	1.0	720
600	*G.E.	TS-7640	1.0	900
500	*G.E.	TS-7657	1.0	514
400	*West.	H	.8	1800
400	West.	HG	1.0	900
300	G.E.	ATI	.8	900
300	G.E.	ATI	.8	720
300	*Ideal	SMM	.9	257
300	G.E.	ATI	.8	1200
250	G.E. New	TS-974Y	.8 (3brg)	720
225	G.E.	TS-6244	1.0	300
225	El. Mch.		1.0	360
200	F-M	TJC-285	.8	720
190	El. Mch.		1.0	720
150	F-M	TJC-285	.8	720
150	G.E.	ATI	.8	720
150	*El. Mch.		.8	1200
150	Westg.	HR	1.0	900
125	*G.E.	TS-7641	1.0	514
125	*G.E.	TS-6214	1.0	277
125	*El. Mch.			900

AND MANY OTHERS

SQUIRREL CAGE MOTORS

3 Phase, 60 cycle, 220 or 440 volts (*2300 volts or higher)

H.P.	Make	Type	Speed
1250	*Al.-Ch.	ANW	1200
800	*Westg.	CS	3600
800	*Westg.	CS-1485	1800
700	Al.Ch.	AN	900
500	*Al.-Ch.	6316-8W	1800
500	G.E.	KT-424	450
400	G.E.	KP-539	3600
400	G.E.	KT-424	380
350	Ideal	A	1800
300	*G. E.	K-6344Y	1200
300	G. E.	K-6353 TEFC	720
250	*L-Allis	OEX-148	720
250	*G. E.	IK	600
250	G. E.	IK-17A	600
200	*G. E.	FT-549Y	3600
200	*G. E.	IK-13B	1800
200	*Al.-Ch.	AN	720
200	Al.-Ch.	ABWWT	885
200	*Westg.	CS	660
200	G. E.	IK-17	600
200	G. E.	K-6352	514
150	G. E.	IE-13A	1800
150	G. E.	IE-13B	1200
150	*Westg.	CS-815 S TEFC	1200
150	G. E.	K-6634	900
150	Westg.	CS-876C TEFC	900
150	*Westg.	CS	600
125	Westg.	CS-771 Sppf.	1800
125	*Al.-Ch.	AR	1800
125	Al.-Ch.	AR-226 CS	1800
125	*Reliance	AA 5085	900
125	Al.-Ch.	AN	900
100	L-Allis	1148-Ex. Pr.	3600
100	Westg.	CS-505S TEFC	3600
100	Westg.	CS-607S TEFC	3600
100	*Westg.	CS	1800
100	*G. E.	FT-542Z	1800
100	G. E.	FT-RP-543	1800
100	G. E.	K-5048	1800
100	G. E.	KT-543	1800
100	*Westg.	CS-760D	1200
100	G. E.	IK	1200
100	Al.-Ch.	ANW-23D	1200
100	*Westg.	CS (Vert)	1200
100	U. S.	CFU (Vert)	1200

SLIP RING MOTORS

3 phase, 60 cycle, 220 or 440 volts (*2300 volts or higher)

H.P.	Make	Type	Speed
1500	*G.E.	MT-30	240
1250	*Westg.	CW	600
1000	*Westg.	CW	250
700	*Al-Ch.	ANY	720
600	G.E.	MT-567	1800
600	*Westg.	CW	450
600	*G.E.	I-P	257
500	Westg.	CW	350
400	Al-Ch.	3 brg.	450
400	*G.E.	MT-412	450
300	*G.E.	IE-15A	1800
300	*G.E.	MT-563	720
250	*Westg.	HP-15H	600
200	*Westg.	CW	1200
200	G.E.	IK-15B	900
200	G.E.	IM	600
150	Cr. Wh.	50-R	1800
150	G.E.	MT-549	1800
150	*Al-Ch.	ANY-30F1	1200
150	Westg.	CW-868A	720
125	G.E.	IM-15A	600
100	G.E.	IT-13A	1800
100	G.E.	IM	600
100	G.E.	IM	450
75	Nor. West.	HW-50	1800
75	G.E.	MT-347	1200
75	G.E.	IM	1200
75	Al-Ch.	ARY-223C	1200
75	G.E.	MT-356	900
75	Al-Ch.	ANY-26F	900

SLIP RING MOTORS

Crane and Hoist Service
3 phase, 60 cycle, 220 or 440 volt

H.P.	Make	Type	Speed
75	Westg.	CI-756A	600
50	Westg.	MW-334	600
50	G.E.	HIC TENV	600
25	G.E.	MTC-5536	600
22	G.E.	ITC-5009	1200
20	Westg.	CI	1200
15	G.E.	TTC-5010	720
11	Westg.	CI-E464	900
10	P & H	BW-6	1800

MOTOR GENERATOR SETS

K.W.	Make	A.C.	D.C.
1000 (3u)	Westg.	11000	137/275
500	Westg.	2300	137/275
500	Westg.	2300	275
400	A.C.	2300	120/240
300	G.E.	2300	250
200	G.E.	2300	250
200	Westg.	4160	250
200	Ridgeway	2300	250
170	G.E.	440	125
150	G.E.	2300	125/250
150	G.E.	4000	250
150	A.C.	2300	275
150	G.E.	440	275
100	Westg.	440	125
100	El. Mch.	440	125
100	G.E.	240	230
100	G.E.	440	125
90	G.E.	440	80
75	G.E.	440	125
60	Westg.	2300	125
60	A.C.	2300	125
50	Reliance	440	250
50	Ideal	2300	250
50	Westg.	240	125
40	G.E.	440	125
40	G.E.	440	250
35	Westg.	2300	150
30	G.E.	440	125
30	Westg.	2200	125
25	L-Allis	440	250
20	Bogue-GE	550	250
20	Bogue-GE	220/440	250
20	Bogue-GE	440	125
15	Westg.	220/440	250

PUNCH PRESS MOTORS

NEW—3/60/220-440 volt
High Torque—High Slip

H.P.	Make	Type	Speed
60/45	G.E.	KR-6325	1090/790
60	Westg.	CS-752-C	1060
60	Westg.	CS-857-C	1085
50	Westg.	CS-505	1080
50	Imperial	E-1584	1090
40	Reliance	AA-B-505	1635
40	Imperial	E-505	1080

CHICAGO *Electric Co.* 1320 WEST CERMAK ROAD, CHICAGO 8, ILL.

BARGAINS

3—1000 KVA 6900x480 Volts, Allis Chalmers late type transformers with taps

1000 K.W., 5-00-2300 volt, 3600 RPM, Gen. Elec., rigid frame Turbo Generator, 300 lbs. condensing, for $3000.00 on Cars.

150 KW., Unused, Westgh. Turbine, 225 lbs. pressure, 25 lbs. back pressure with extended base for Generator.

A. C. H. Wheeler tube jet air ejector, inter and after condensers, capacity 2000 lbs. per hour free air at 3.5 lbs. for $400.00.

8—200 KVA, Allis Chalmers transformers, 2300 to 115-230 volts, at $450.00 each, FOB Trusk

2—500 KW., 230/115 Volt, 3 wire, 1200 RPM, Gen. Elec. Rotary Converters

1—300 KW., 230 Volt, 1200 RPM, type MCP, Gen. Elec. motor generator

1—4000 amp. 18-20 volt, Hansen Van Winkle Munning Generator, to a 75 HP, 3-60-440 volt, 600 RPM, Gen. Elec. syn. motor

40—20 to 50 HP, high speed, new Lewis Allis ball bearing motors at special prices

We carry a large stock of Motors, A.C. and D.C., Transformers, Motor Generators, Turbo Generators, and sts.

WE SOLICIT YOUR INQUIRIES.
WHAT HAVE YOU FOR SALE?

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8403 Hegerman St., Phila. 36, Pa.

30 HP 200 lb. P. Erie City Economic Boiler
80 HP 125#—30 HP 100# E. City Eco. Boilers
13.2 HP 125# S. Marine Boiler w/gas burner
3—300 HP Erie City 160 lb. WT Boilers
3—109 HP Kewanee Boilers w/oil burners
72x20 HRT Boiler—150 lbs. Pressure
500—375—120 KVA Engine—Gen. Sets
150 KW Syn. Motor Generator Set—Complete

H. & P., 6719 Etzel, St. Louis 14, Mo.

BOILERS

Bought • Sold • Rented

2—202 H.P. 250 Lb. Scotch Marine Type External Dutch Oven Fired Walsh-Widener Boilers

165 H.P. Scotch Marine 15 Lb. Press. Titusville.

Cyclotherm 200 H.P. 15 Lb. Heavy Oil

750 Deg.—1,600,000 B.T.U.—125 Lb. International-Dowtherm Boiler

2—25 H.P. Ames Package Boilers 1949. 1951—Gas or Light Oil—100 Lb. 50 H.P.—150 Lb. Steamaster

10-15-30 H.P. 125 Lb. Package Boilers

BOILER & EQUIPMENT CO.
743 Bedford Ave. Brooklyn 5, N. Y.
ULster 5-3588

400 KW NON-CONDENSING TURBINE GENERATOR

500 KVA—400 KW, 80% PF Allis Chalmers generator, 3 phase 60 cycle, 480 volt, 1200 RPM connected through reduction gear to a:

400 KW Terry non-condensing turbine, 325-400#, 100-125# gauge back pressure, 3800 RPM. Direct connected exciter, switchboard, instruments, spare parts. RECONDITIONED.

UTILITIES MACHINERY CORP.
1965 E. SIXTH ST., CLEVELAND 14, OHIO

FOR SALE
18 NEW TURBINES

4 horizontal, 14 vertical, Westinghouse

Driving forced draft blowers—capacities ranging from 39000 to 56000 CFM and 16" to 24" pressure. Steam pressures 360 to 575#, back pressure 10#.

Will sell turbines separately if desired. *Price reasonable.*

Also—1—250 KW GE turbo generator unit, 3 phase, 60 cycle, 440 volt. Used one year.

G. M. DeROSE
2457 WOODWARD AVE.
408 DONOVAN BLDG.
DETROIT 1, MICH.

3—333 KVA—1-60-33000 to 2300/4000 V. General Electric outdoor transformers.
4—100 KVA-3-60-2400-120/208 V. Pyranol transformers each with 275 A. 600 V. 3 pole air breaker.
1—150 HP-900 rpm-440-3-60 GE synchronous motor exciter and automatic starter.
1—100 HP-870 rpm-440-3-60 NEW Elec. Mach. Mfg. Co. Magnetic Drive and Regutron Control.
H. BLAINE JOHNSON & ASSN.
53 W. Jackson Blvd. Chicago 4, Ill.

30 TON BRIDGE CRANE

65 ft. span—Northern Engineering Co. Fish belly fabricated—travel motor—trolley motor—30 ton hoist—15 ton auxiliary hoist motor. All 230 volt DC motors—mfg. by G.E.—cab controlled with G.E. controls. Can be seen in operation.

IMMEDIATE DELIVERY

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There's more than 40% to 60% SAVINGS on

SCHOONMAKER DEPENDABLE DIESEL POWER

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Each Schoonmaker-sold Diesel Engine Unit is fully RE-MANUFACTURED in our plants by highly skilled, factory-trained Diesel engineers. Only genuine factory-made and approved parts are used and all REMANUFACTURING is in strict accordance with manufacturer's recommended procedures. Prior to shipment every engine is subjected to a FULL LOAD operating test in accordance with DEMA standards.

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So—Buy SCHOONMAKER because you buy the FINEST in DEPENDABLE DIESEL POWER.

America's largest source of New and Remanufactured Diesel Power

PORTION OF ENGINE REMANUFACTURING FLOOR AND ONE OF THE ENGINE TEST STANDS AT OUR SAUSALITO, CALIF. PLANT

A PARTIAL LIST OF OUR INVENTORY

KW	MAKE	MODEL	HP	RPM
1180	Worthington	SEH-8	1685	360
1136	Fairbanks Morse	38D	1600	720
1100	General Motors	16-278A	1600	720
750	General Motors	12-567	1080	720
700	Worthington	EE-8	1000	327
600	General Motors	12-567	900	600
*500	Alco	6-12½x13T	750	600
500	General Motors	8-567	720	720
*350	Baldwin	VO-6	510	450
320	Superior	60-S-6	460	450
*320	Enterprise	DSG-6	460	450
300	General Motors	8-268A	450	1200
200	General Motors	8-268A	350	900
*160	Buckeye	80	240	600
*150	Worthington	CC-4	225	450
148	Fairbanks Morse	32E14	225	300
100	General Motors	3-268A	150	1200
60	General Motors	6-71	90	1200

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50 CHURCH ST., NEW YORK 7, N. Y.
PLANTS AND WAREHOUSES:
EDDYSTONE, PENNA. AND SAUSALITO (S.F.), CALIFORNIA

BOILERS

9—304 HP, Kewanee, Firebox, Model 590, 125 PSI, ASME with soot blowers.
4—150 HP, Casey Hedges, HRT, 150 PSI, ASME, gas fired.
1—50 HP, Titusville, 150 PSI, adaptable gas or oil firing.

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Many years experience and service in POWER EQUIPMENT
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Boilers	Motor Generator Sets	Oil & Air Circuit Breakers
Transformers	Frequency Changers	Feeder Voltage Regulators

Your inquiries stating your needs will receive our careful and prompt attention

BREW, WOLTMAN & CO., INC., 50 Church St., New York 7

1000 KW NON-CONDENSING TURBINE GENERATOR

1250 KVA—1000 KW, 80% PF, General Electric alternating current generator, 3 phase 60 cycle, 2300/480 volt, 3600 RPM, direct connected to a:

1000 KW General Electric non-condensing steam turbine, 125-150#, 10-15# gauge back pressure.

Direct connected exciter, switchboard, instruments and spare parts.

UTILITIES MACHINERY CORP.
1965 E. SIXTH ST., CLEVELAND 14, OHIO

POLE LINE SWITCHES

Q.	Make	Type		Volt	Amp.	Control	Int. Cap.
12	Condit	PK-5	3 pole	4,500	200	Non-Auto.	10,000
10	El. Spec.		3 pole	7,500	200	Non-Auto.	10,000
2	Condit	P-50	3 pole	7,500	200	Motor	15,000
7	Westg.	FO-22-A	3 pole	7,500	400	Elec.	50,000

W. B. McCLURE, 105 Stoy Ave., Westmont, N. J.

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needs your idle equipment! Reach that buyer quickly and economically thru the
"SEARCHLIGHT SECTION"
The meeting place of Used Equipment Buyers and Sellers

M-G SETS! MOTORS!

1—500 KW, 240 V. D-C, Whse. M-G Set, 900 RPM, Syn. Drive, 3/60/220, Ser. 4979926, w. magnetic reduced voltage starter.

3—405 KW, 270 V. D-C, G.E. M-G sets, 900 RPM, ATI Sync. Drive, 3/60/2300 Ser. 4098425

TURBO GENERATOR

1—750 KW, Elliott, condensing, 200 PSIG, 112° superheat, 28" Vac., 3/60/480—modern.

SYNCHRONOUS MOTORS

1—200 HP, F-M, 300 RPM, Type TZO, Fr. 5, 440 volt.

1—150 HP, G.E. 277 RPM, Type ATI, 2300 volt, w. C-H mag. clutch.

1—125 HP, E-M, 600 RPM, Type BRKT Fr. 4, 2200 or 220/440 volt.

AMMONIA COMPRESSORS

2—10"x10" Frick with 200 HP, 300 RPM, F-M syn. motor, center drive, direct connected, 3/60/440 (or 220 V.)

Amt.	HP.	Speed	Make	Type	Frame
3	250	600	G.E.	KT568	(2200V)
1	150	1800	Whse.	CS(2200V)	8718
1	150	1800	A.C.	26F-220-43-10	(2200V)
1	150	900	G.E.	I-K(2200V)	15
1	125	1200	Wag.	26WBP	
1	125	1800	Whse.	CS	4 Mil.
1	110	900	G.E.	I-K	
1	100	1800	Howell	K(TEFC)	505
1	100	1800	Whse.	CS	663C
1	100	1200	Whse.	CS	752C
1	100	1200	A-C	AR(2200V)	823E
1	100	900	A-C	2200 V.	2K20064.1
1	50	1720/575	L-A	Adjusto-Spede	445

SLIPRING MOTORS

1	100	900	G.E.	MT356	
1	100	450	G.E.	I-M(2200V)	16
2	75	720	A.C.	(1-2200V, 1-440V)	
2	75	900	G.E.	I-M	

PARTIAL LISTINGS—10,000 OTHER MOTORS IN STOCK—NEW & REBUILT—A.C. & D.C.
NEW MOTORS AT LONG DISCOUNTS.

BENSON-WILIMZIG, INC.

1708 North 8th St. Phone—Garfield 1-4290 St. Louis 6, Missouri

Do you need a 250 H.P. LOW PRESSURE BOILER?

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Cliff Steel, Built Terra Haute, Ind., 1946—used 5 years (in fine condition) Horizontal Fire Tube, Complete with Petro Oil Burner (#6 fuel oil) 48" Stack Fan and 35' Stack; Protector Relays and Controls; Ignition Transformer Pump, Oil Valves. Boiler and Equipment originally cost $15,000.00.

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ENGINE AND AIRPLANE CORPORATION
FAIRCHILD
Aircraft Division
HAGERSTOWN, MARYLAND

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We carry a large stock of rebuilt and guaranteed transformers and invite your inquiries.

Custom-built transformers and coils manufactured to your specifications.

Expert Repair Service—all makes and sizes of transformers rewound, repaired and redesigned. Ask for our price schedule.

THE ELECTRIC SERVICE CO., INC.

5331 Hetzel St. Cincinnati 27, Ohio

40 Years' Dependable Service

COMPLETE POWER PLANTS

STEAM — ELECTRIC — HYDRO — DIESEL

BOILERS *"Export Orders Carefully Executed"* BOILERS

TRY US with your INQUIRIES for ALL POWER MACHINERY

CHARLES B. REARICK 30 CHURCH ST. NEW YORK 7, N. Y.

SAVE UPWARDS OF $75,000
140,000 #/Hr.—450# W.P.
NEW—UNERECTED BOILER
COMBUSTION ENGINEERING CO.
Type VU-50 with Waterwalls
FS-4251, POWER
330 W 42 St., New York 36, N. Y.

MOTORS · MG SETS

Qty.	HP	Make	Voltage	Speed
12	3000	West.	525/600	600 RPM
26	1500	West.	525/600	600 RPM
32	1500	Al. Ch.	525/600	675 RPM
4	1200	Al. Ch.	525/600	650 RPM
2	900	Elliott	220	300/195 RPM
3	800	West.	525/600/600/900	RPM
1	650	Cr. Wh.	230	475/720 RPM
1	500	West.	230	250/500 RPM
1	400	G.E.	230	180/360 RPM
7	400	Elliott (new)	230	400/800 RPM
5	400	West. (new)	230	375/750 RPM
2	350	Cr. Wh.	230	400/800 RPM
1	200	Cr. Wh.	230	500/750 RPM
1	200	Cr. Wh.	230	375/750 RPM

All motors designed for mill reversing service.
Smaller sizes also in stock.
Motor Generator Sets in Stock
100—2000 KW Capacity
All of above is modern late type equipment remanufactured & tested by our engineers.
Write, Wire, Phone
All guaranteed for one year

A. G. SCHOONMAKER CO., INC.
50 CHURCH STREET, NEW YORK 7, N. Y.
Plants: SAUSALITO (S.F.) C/L., JERSEY CITY, N.J.

NONCONDENSING TURBO UNITS

1250 KVA General Electric generator, 3 phase, 60 cycle, 2300/480 volts, direct connected to General Electric noncondensing turbine, 150 lbs. steam pressure, 15 lbs. back-pressure.

2500 KVA General Electric generator, 3 phase, 60 cycle, 480 volts, direct connected to General Electric noncondensing turbine, 150 lbs. steam pressure, 15 lbs. back-pressure.

3750 KVA General Electric generator, 3 phase, 60 cycle, 480 volts, direct connected to General Electric noncondensing turbine, 150 lbs. steam pressure, 15 lbs. back-pressure.

EXCELLENT CONDITION

INTERNATIONAL POWER MACHINERY CO.
1610 Union Commerce Bldg., Cleve. 14, O.

SYNC. MOTORS

2—3500 H.P. 2300/3/60/257 RPM G. E. Synchronous motors with water cooled heat exchangers and motor generator exciter set used only 100 hours.

SOUL CLINIC INC.
Calgary, Alberta, Canada

WESTINGHOUSE 1000 K.W. STEAM TURBO-GENERATOR

New 1930. Excellent condition. 160# p.s.i.g., 2300 Volts. Complete with condenser, exciter, circulating and condensing pumps, air ejector. **Excellent buy.** Write.

SOUTHLAND PAPER MILLS
Lumber Division, Trinity, Texas

PACKAGE TYPE—WATERTUBE
BABCOCK & WILCOX
INTEGRAL FURNACE TYPE
15,000 #/Hr.—250# W.P.
New Tubes—New Refractories
FS-4242, POWER
330 W. 42 St., New York 36, N. Y.

1000 KW DIESEL GENERATOR SET

G. E. 3 Ph., 60 Cy., 2300 Volts, 300 RPM, Complete with Starting Equipment & Switchboard. Overhauled. Ready to ship.

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904 Pacific St. • Brooklyn 16, N. Y.
STerling 3-6515

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All are 2300 volt—3 phase—60 cycle with exciters, switchboards, governors. Will consider offers for complete units or without waterwheels.

Vertical unit—625 KVA—257 RPM—65 foot head
Vertical unit—500 KVA—257 RPM—40 foot head
Vertical unit—438 KVA—257 RPM—30 foot head
Vertical unit—500 KVA—225 RPM—36 foot head
Vertical unit—312 KVA—100 RPM—12 foot head

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264 Kossuth St., Bridgeport, Conn.

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1—150 KW, 275 V, D.C. G.E., 1200 RPM, Type MTC with synchronous drive, 3/60/2300-440, Ser. #3,940,286

1—300 KW, 125 V, D.C. W.H., 900 RPM, Type SK, with synchronous drive, 3/60/2300 Ser. #1S5F751

1—125 KW, 150 V, D.C. W.H., 1200 RPM, Type SK183 with synchronous drive, 3/60/2300-440, Ser. #4,905,914, very late type.

2—35 KW, 125 V, D.C. G.E., 1200 RPM, Type CDM105, synchronous motor drive, 220/440/3/60, Type TS.

PLATING AND ANODIZING

1—45 KW, 6/12 V, D.C., 400 RPM, Type N123, 5000/2500 Amp, Chandyssen synchronous drive, 220/440/3/60.

1—125 KW, 30 V, 4500 Amp, Ridgeway with 200 Hp synchronous motor drive, 220/440/3/60-720 RPM.

BATTERY CHARGERS

1—18 KW, 30 V, 600 Amp, G.E. 1200 RPM, Type CD-103y, 1200 RPM, 30 HP, 220/440/3/60.

1—100 KW, 60 V, 1600 Amp, G.E., 900 RPM, 150 HP, S.C. Motor drive, 220/440/3/60

MOTORS

Qu.	HP	Make	Frame	RPM	Type
8	150	G.E.	364-Open	600	KT BB, Ped. Brg.
1	100	W.H.	Open	720	CS-SS
1	100	G.E.	6326-TEFC	900	KG-XP
1	400	W.H.	Open-2300	900	Sync. Ped. Brg.
1	400	Al. Ch.	Open-2300	1800	S.R.

BOILER

1—30 HP Cleaver Brooks, Oil Fired, Rkg. Type Like New

BUCKEYE TRADING CORPORATION
1017 Papin Street, St. Louis 2, Missouri
CHestnut 1-3110

37 Years Dependable Service

SLIP RING MOTORS 3-Ph., 60 Cy.

H.P.	Volts	Make	Speed
600	2200	Whse.	450
500	2200/4000	G. E.	900
450	440	Whse.	514
450	440	Whse.	720
300	2200/440	G. E.	720
300	440	G. E. (hoist)	600
300	2200	G. E.	300
300	440	Whse.	3600
250	440/220	Whse.	600
250	550/440	G. E.	1200
200	440/220	Whse.	514
150(2)	440/220	G. E.	720
150	2200/440	G. E.	600
135	440/220	G. E. (hoist)	600
125	440/220	G. E.	900
125	550/440	G. E.	1200
125	2200	G. E.	600

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

H.P.	Volts	Make	Type	R.P.M.
400	2200/440	G. E.	ATI	720
375	440/220	Whse.	G	900
350	440/220	El. Machy.	Syn.	1200
300	2300/400	G. E.	TS	720
300	2200/440	G. E.	TS	1200
250	2200/440	G. E.	TS	720
250	440/220	Whse.	HR	277
250	440/220	G. E.	ATI	600
125	440/220	Whse.	HR	400

SQUIRREL CAGE MOTORS

H.P.	Volts	Make	Type	Speed
600	2200	G. E.	FT	3600
500	2200/4000	Elliot	SC	1800
500	2200	G. E.		450
400	2200/400	Whse.	CS	720
300	2200	L. Allis	FS	1800
225(2)	2200/440	G. E.	KT	1200
200	440	G. E.	IK	720
200	440/220	G. E.	KT	1800
200	2200/440	G. E.	JK	600
200	2200	G. E.	KT	1800
150	440/220	Whse.	CS	900
150	2200	Al. Chal.	AR	1800
150	220	Whse.	CS	1200
150	440/220	G. E.	IK	450
150	440/220	G. E.	KT	720
150	2200/440		KT	600

A. C. GENERATORS

1—320 kva, 660 rpm 2300/440/220 V., G.E.
1—300 kva, 900 rpm, 480/220 V., G.E.
1—225 kva, 600 rpm, 220/440 V., G.E.
1—200 kva, 720 rpm, 2200/440 V., G.E. (Ball)
1—187 kva, 1200 rpm, 2200/440 V., Whse.

CIRCUIT BREAKERS

2—3000 amp. GG E., 3 pole, 600 V.
2—1600 amp. ITE, 3 pole, 600 V.
6—FKR-155-28, 600 amp., 15,000 V., G.E.
1—FKR-143, 1200 amp., 4500 V., G.E., Sol. op. (new)

D. C. MOTORS

H.P.	Volts	Make	Type	Speed
225	230	Whse.	SK	2870
150	230	Whse.	SK	1750
100	230	Whse.	SK	400/1200
90	230	G. E.	CD	1750

MOTOR GENERATOR SETS

KW	Make	Input V., AC	Motor Type	Output V., DC
250	Whse.	2200	Syn.	250
175	G. E.	220/440	Syn.	230
125	G. E.	440/220	Syn.	250/125
100	Al. Ch.	220/440	sq. ca.	240/120
100	Whse.	440/220	sq. ca.	125
75	G. E.	2200/440	Syn.	125
65	G. E.	2200/440	sq. ca.	250

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1—600 kva, Standard, 13,800-2300 V., 3 ph.
3—500 kva, Whse., 66000—2300 V.
3—333 kva, G. E., 12000—2300 V.
3—200 kva, G. E., 2300—575 V.
3—200 kva, G. E., 11000—2300 V.
3—200 kva, G. E., 4150—480/240 V.
3—150 kva, Al. Chal., 2400—240/480 V.
6—100 kva. Whse., 2400—120/240 V.

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150	Westg.	1200
100	Cr. Wh.	1200
100	E.M.	1200
100	G. E. (2)	900
100	Westg.	1200
100	Westg. (2)	900
75	G. E. (2)	1200
50	Westg. (2)	1150

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KW	Make	Speed
750	G. E. (2)	NEW
300	West. (2)	900
250	Cr. Wh.	1200
200	El. Mchy.	900
150	G. E.	1200
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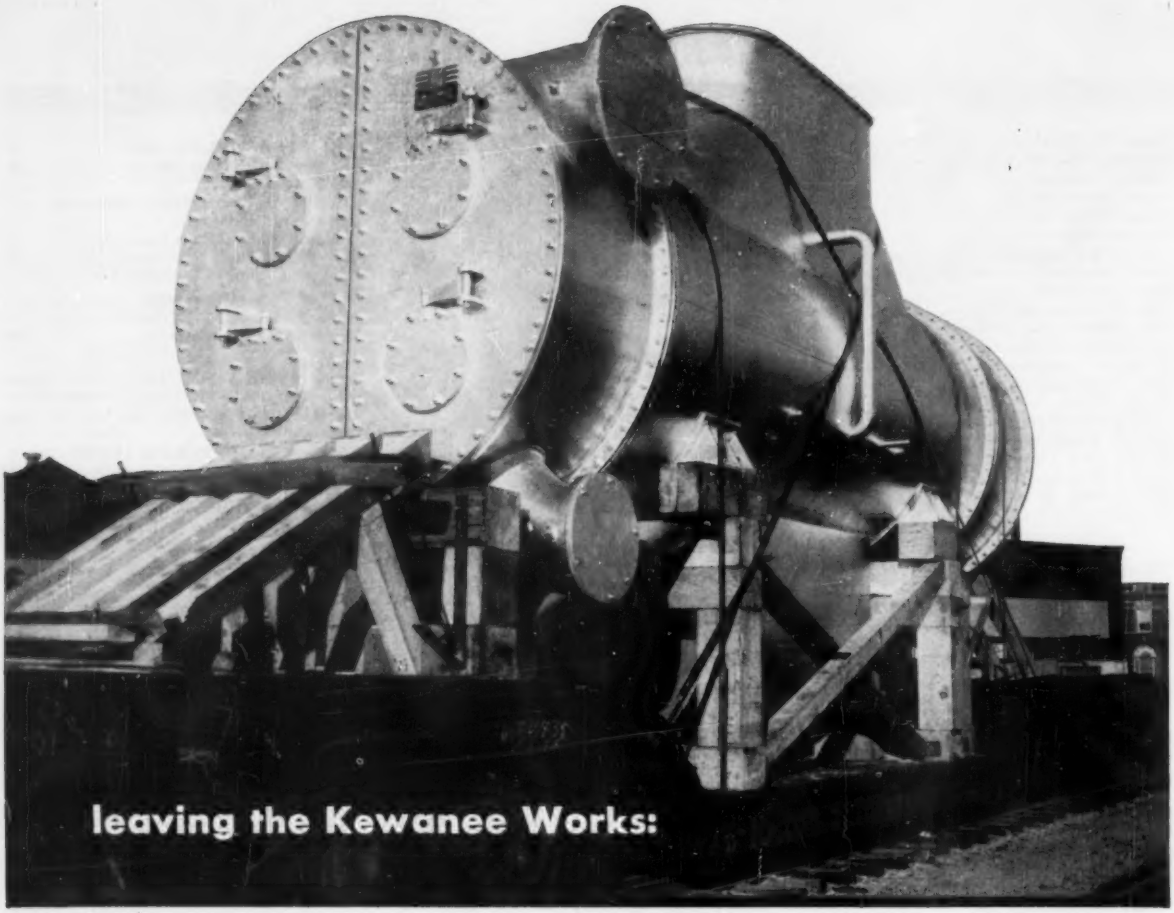

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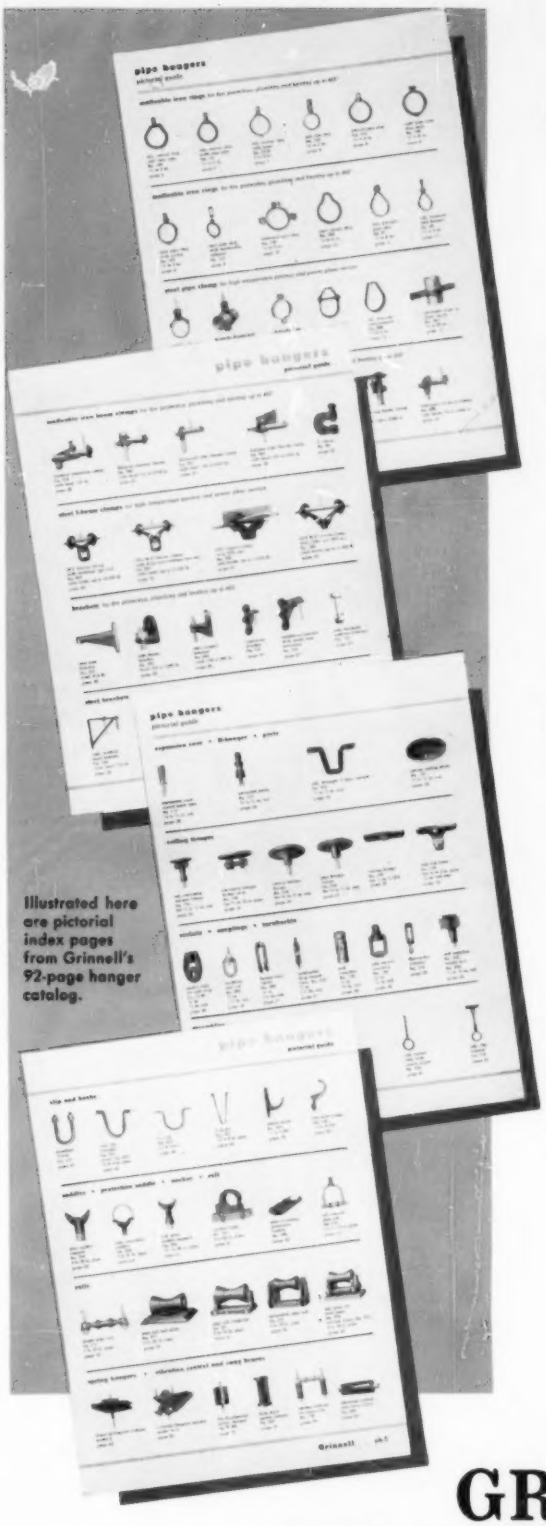

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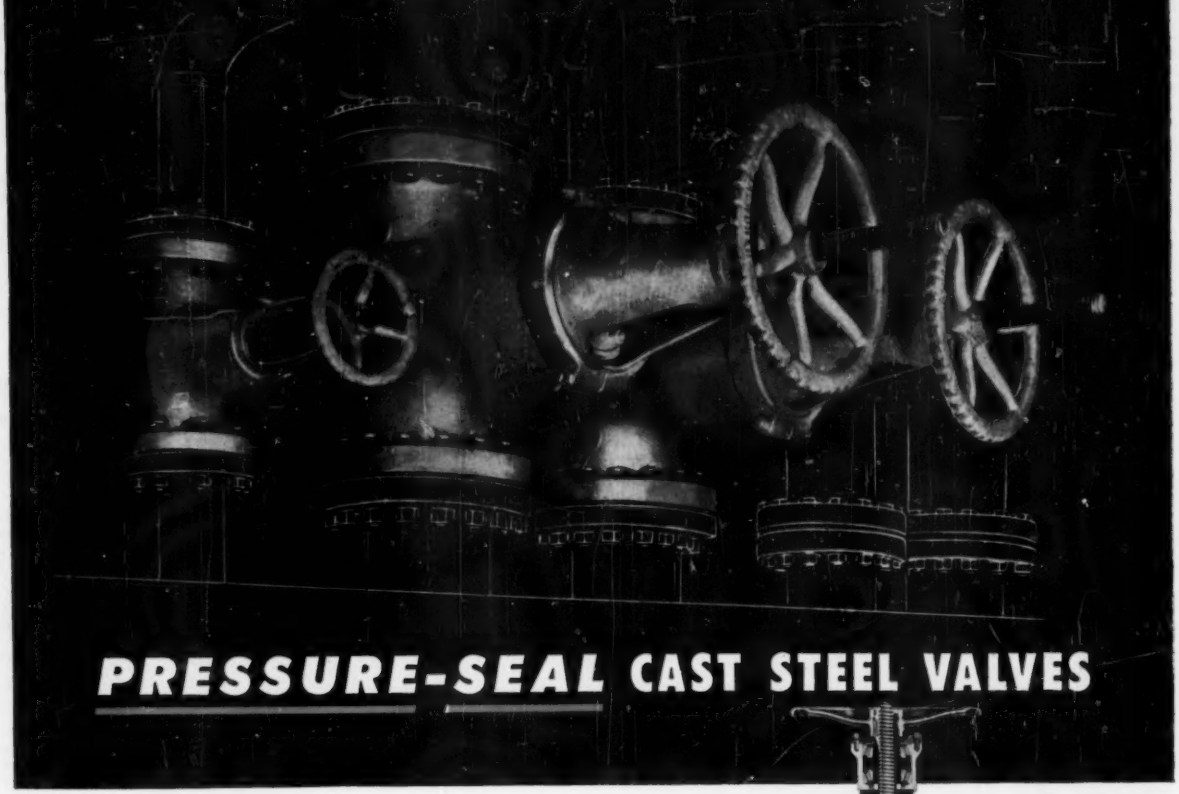

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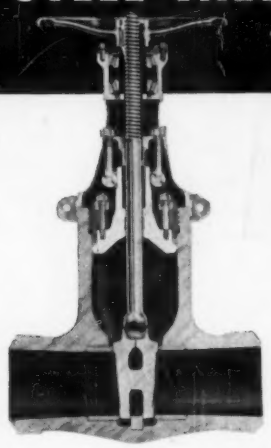

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